No. 8136

# JVC Service Manual

## PORTABLE VIDEO CASSETTE RECORDER VHS PAL

## MODEL HR-4100E

## AC POWER ADAPTER

## MODEL AA-P41E

VICTOR COMPANY OF JAPAN, LIMITED.

No. 8136

# JVC Service Manual

MODEL **HR-4100E**

VICTOR COMPANY OF JAPAN, LIMITED

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**AA-P41EG/EK**

| | | |
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# SECTION 1
# GENERAL DESCRIPTION

## 1.1 INTRODUCTON

This manual provides service information for the JVC VHS Model HR-4100E. The manual describes the principles and adjustments of mechanical electrical operations for this model.
Service procedures given herein cover only field maintenance services.
Adjustments which require high-level instruments, jigs and techniques are excluded, since they should be performed at the factory.
Due to design modifications, the servicing procedures and data given in this manual are subject to possible change without prior notice.

VHS PAL™
Only cassettes marked VHS can be used with this video cassette recorder.

## 1.2 WARNING FOR HR-4100E

**WARNING:** Many of the programs broadcast by television stations are protected by copyright and Federal law imposes strict penalties for copyright infringement. Some motion picture companies have taken the position that home recording for non-commercial purposes is an infringement of their copyrights. Until the courts have ruled on the proper interpretation of the law as applied to home video recording, this equipment, if used to record copyrighted material, will have to be operated at the user's own risk.

**WARNING:**
**TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE.**

**This video cassette recorder should be used with 12 V DC only.**
**CAUTION:**
**To prevent electric shocks and fire hazards, do NOT use any other power source.**

## 1.3 FEATURES

- Lightweight, compact, easy-to use portable.
- Flexible 3-way power supply arrangement – battery, household AC and car battery
- Automatic recharging of the built-in battery possible with the optional AA-P41E AC Power Adapter.
- Economical power consumption of 10 watts.
- Excellent pictutre equality assured by the built-in full color recording and playback circuitry.
- May be connected most TV receivers with the built-in RF converter.
- Temporary tape stops possible with the pause control.
- Audio dubbing facility provided to modify the sound track on prerecorded tapes.
- Search machnism facilitates locating a particular tape section.
- Automatic switching between the camera input and the line input.
- Drop-out compensator built in to compensate for tape aberrations caused by oxide drop-out, producing clean pictures.
- Automatic switching between color and monochrome signal processing.

## 1.4 SPECIFICATIONS

| | |
|---|---|
| Format | : VHS standard |
| Recording system | : Rotary, slant azimuth two-head helical scan system |
| Video signal system | : PAL-type color signal, 625 lines |
| Tape width | : 12.7 mm (1/2 inch) |
| Tape speed | : 23.39 mm/s |
| Maximum recording time | : 180min. (with JVC E-180 video cassette) |
| Power requirement | : 12 V DC |
| Power consumption | : 10 watts |
| Temperature | |
| Operating | : 0° to 40°C (32° to 104°F) |
| Storage | : –20° to 60°C (–4° to 140°F) |
| **Video** | |
| Input | : 0.5 to 2.0 Vp-p, 75 ohms unbalanced |
| Output | : 1.0 Vp-p, 75 ohms unbalanced |
| Horizontal resolution | : More than 240 lines (color mode)<br>More than 300 lines (B/W mode) |
| Signal-to-noise ratio | : More than 40 dB (Rhode & Schwarz noise meter) |

**Audio**

| | |
|---|---|
| Input | : Mic.: −67 dBs, 10 k-ohms unbalanced<br>Line: −20 dBs, 50 k-ohms unbalanced |
| Output | : Line: −6 dBs, 1 k-ohm unbalancec |
| Frequency response | : 70 Hz to 10 000 Hz |
| Signal-to-noise ratio | : More than 40 dB |
| RF output | : UHF channel 32–40 |
| Dimensions | : 33.8 cm(W) x 13.7 cm(H) x 32.8 cm(D)<br>(13-3/8" x 5-7/16" x 13") |
| Weight | : 7.5 kg (16.5 lbs.)<br>9.3 kg (20.5 lbs.) including cassette*, battery pack and RF converter.<br>(* optional) |
| Accessories provided | : PBP-1 Battery Pack, Earphone, RF converter, Aerial cable |
| Optional accessories | : CB-35U Carrying case for HR-4100E,<br>RM-42 Pause mode remote control switch,<br>PBP-1 Spare battery pack |

*Design and specifications subject to change without notice.*

## 1.5 PRECAUTIONS

**Avoid using the** HR-4100E. **under the following conditions:**

- Extremely hot or cold places
- Near appliances generating strong magnetic fields
- Moving from a cold to a warm place
- Places subject to excessive humidity, dust or vibrations

**Remember the following:**

- Do not place heavy objects on the HR-4100E.
- Do not apply shocks to the HR-4100E.
- Prevent inflammables, water and metallic objects from entering the **HR-4100E**
- Always keep the PBP-1 battery pack fully charged. (The battery pack will gradually discharge in storage. Always recharge the battery pack immediately after use, regardless of how much to the power has been consumed.)
- Use the AA-P41E AC power adapter to operate the HR-4100E household AC current.
- Before switching off the power switch of the AC power adapter, be sure to press the STOP key.
- Make it a rule to remove the cassette from the recorder when you are not using it. If you carry the recorder with the cassette in place and the tape engaged in the transport mechanism, the recorder might be damaged.

## 1.6 CONTROLS AND CONNECTORS

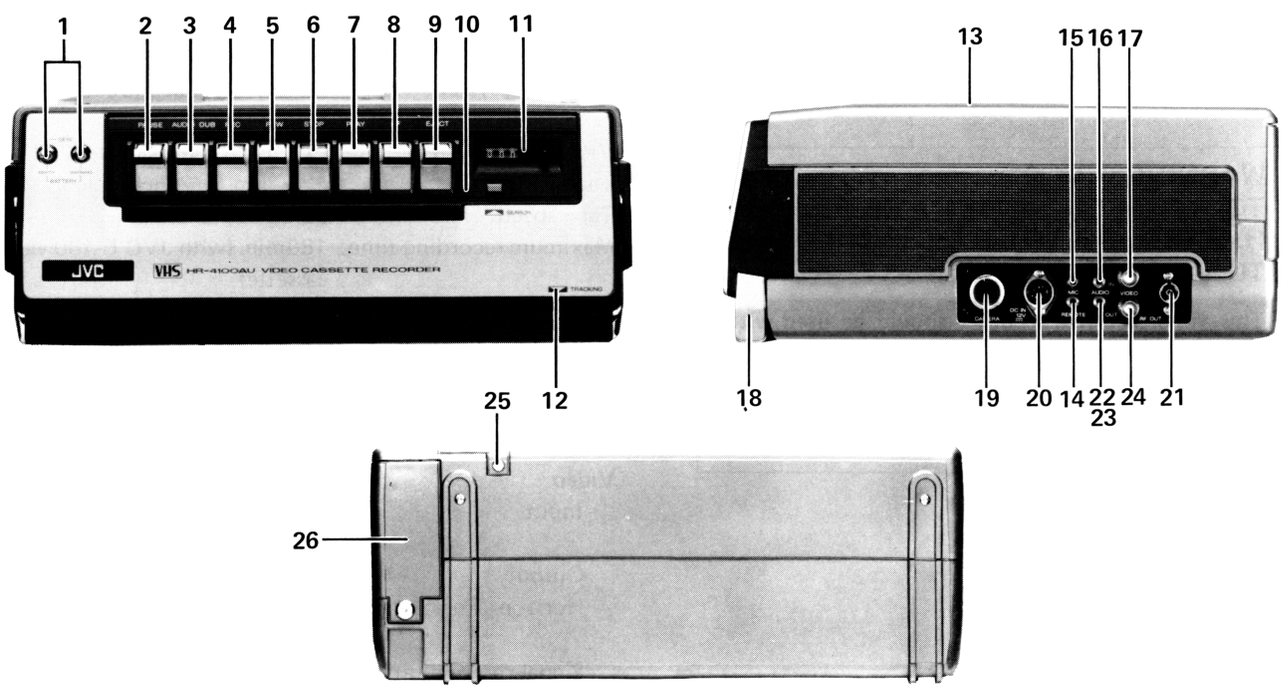



**Fig. 1-1**

1. **EMPTY/WARNING lamps**
These lamps inform you by lighting or flickering when the PBP-1 battery pack installed in the recorder nears the end of its power or when moisture condenses inside the set. See subsection 1.7.
2. **PAUSE key**
Press to stop the tape temporarily during recording or playback.
3. **AUDIO DUB key**
Press together with the PLAY button to record the sound onto a previously recorded tape.
4. **REC key**
Press together with the PLAY button to record.
5. **REW key**
Press to rewind the tape.
6. **STOP key**
Press to stop the tape.
7. **PLAY key**
Press to play back the tape.
8. **FF key**
Press to fast forward the tape.
9. **EJECT key**
Press to lift the cassette holder for insertion or removal of the cassette.
10. **SEARCH button**
With this button depressed, the tape stops automatically when the counter reaches "999" in the Rewind mode.
11. **Tape counter**
Convenient in finding the starting point of a desired section of the tape. The counter is reset to "000" by pressing the reset button.
12. **TRACKING control**
Turn to clear the picture of noise bars, if appearing, during playback.
13. **Cassette holder**
14. **REMOTE control jack**
The pause function can be remote-controlled by connecting an optional remote control switch to this jack.
15. **MIC jack**
For connection of a microphone.
16. **AUDIO IN connector**
For connection of a tape recorder, etc.
17. **VIDEO IN connector**
Connect a video signal source other than that from the JVC portable video camera.
18. **Carrying handle**
19. **CAMERA connector**
Connect the JVC portable video camera GC-4100E.
20. **DC IN connector**
When the unit is to be powered through the AA-P41E AC Power Adapter, connect the adapter to this connector.
21. **RF OUT jack**
The output from the built-in RF converter is available from this jack. Connect to a TV receiver.
22. **EAR jack**
Connect the provided earphone to monitor the sound being recorded.
23. **AUDIO OUT connector**
The audio signals being recorded or played back are available.
24. **VIDEO OUT connector**
The video signals being recorded or played back are available.
25. **RF converter compartment**
The RF converter, preset to UHF 36, is built in. Adjustable to UHF channels 32 through 40.
26. **Battery compartment**
Install the exclusive PBP-1 battery pack here.

## 1.7 WARNING LAMPS

The HR-4100E incorporates special circuits for detecting and warning of the battery power condition and moisture condensation. If one or both of the warning lamps should light or flicker, check the following points.

**If the battery power is insufficient . . . .**
The yellow WARNING lamp lights to indicate that the built-in PBP-1 battery pack is nearing the end of its power.
Then the red EMPTY lamp lights. If the recorder continues to be used in this state, the battery pack will fully discharge and be unable to be recharged . . . unusable in the future. Therefore, if the red lamp lights, immediately recharge the battery pack or replace it with another charged battery pack.

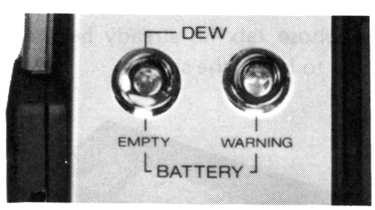



**Fig. 1-2**

**CAUTION!**
Over-discharged battery packs are not reusable, being impossible to be recharged. Be careful!

**If moisture condenses inside the recorder . . . .**

**Moisture condensation**

If you pour a cold liquid into a glass, water vapor in the air will condense on the surface of the glass. This is called moisture condensation. Moisture condensation on the head drum, one of the most crucial parts of the video recorder, will cause damage to the tape.

**Mosture condensation will happen. . . .**

- When you move the recorder from a cold place to a warm place
- after heating a cold room
- under extremely humid conditions

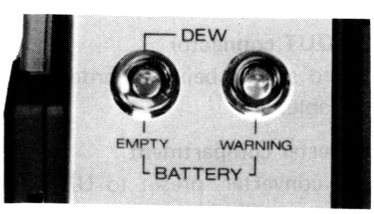



Fig. 1-3

**The red lamp flickers to warn of moisture condensation.**

The recorder does not function in this condition. Wait a few hours for the condensation to dry.

**Note:**

The warning lamps may light briefly when you operate the control keys. This is not due to any defect in the unit.

## 1.8 A WORD ON VIDEO CASSETTES AND EXCLUSIVE PBP-1 BATTERY PACK

**Video cassettes**

Employ video cassettes carrying the VHS mark.

E-180 for 3 hours of recording, E-120 for 2 hours, E-60 for 1 hour and E-30 for 30 minutes are available.

VHS video cassettes are equipped with a safety tab to prevent accidental erasure. When the tab is removed, recording cannot be performed. If you wish to record on a cassette whose tab has already been removed, use cellophane tape to block the slot.

Fig. 1-4

**Handling and storage of video cassettes**

- Avoid exposing the cassettes to direct sunlight. Keep them away from heaters.
- Avoid extreme humidity, violent vibrations or shocks, strong magnetic fields (near a motor, transformer or a magnet) and dusty places.
- Place the cassettes in cassette cases and position vertically.

**Exlusive PBP-1 battery pack**

Correct use of the PBP-1 battery pack:

- The PBP-1 is a lead/acid battery, therefore, when it is used at temperatures below 5°C (41°F), its capacity may be reduced as much as half.
- The PBP-1 is rechargeable. For recharging procedures, see subsection 1.10.
- A fully charged battery pack will provide power at normal temperature of 25°C (77° F)
  - for about 3 hours when the HR-4100E is used alone (for playback), or
  - for about 1 hour when the HR-4100E is used in combination with the GC-4100E color video camera, or
  - for about 1.5 hours when the HR-4100E is used in combination with the GS-1000E B/W video camera.

Be sure not to short-circuit the inner pin to the outer rim of the plug.

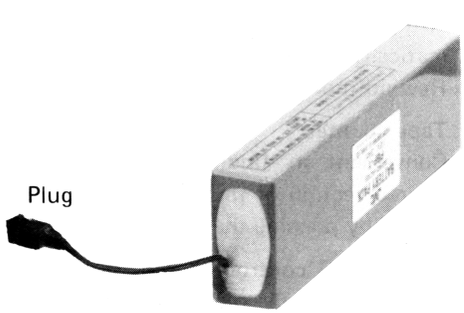



Fig. 1-5

**Note:**

Even when you are not using the battery pack for a long period, do not forget to recharge it from time to time. The battery pack will discharge gradually and become unusable.

## 1.9 LOADING AND UNLOADING THE VIDEO CASSETTE

### Loading

1. Depress the EJECT key. The cassette holder will pop up.

Fig. 1-6

2. Load the cassette in the proper manner as shown. An inverted cassette cannot be inserted.

Fig. 1-7

3. Press the front part of the holder down to lock in the cassette.

Fig. 1-8

### Unloading

1. Make sure that the recorder is in the Stop mode.

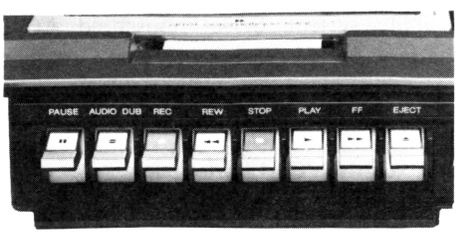



Fig. 1-9

2. Depress the EJECT key.

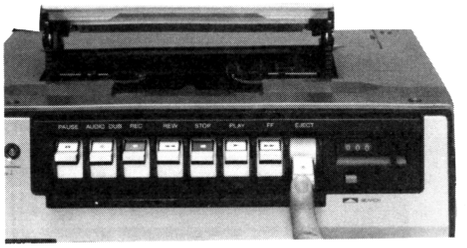


Fig. 1-10

3. Remove the cassette.

Fig. 1-11

4. Press down on the holder.

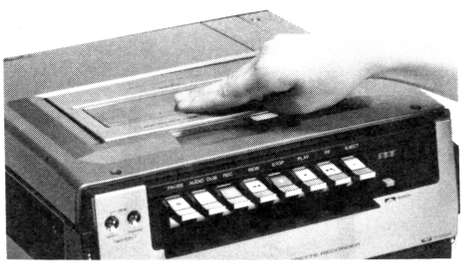


Fig. 1-12

## 1.10 RECHARGING THE PBP-1 BATTERY PACK

The AA-P41E AC power adapter can recharge two PBP-1 battery packs simultaneously; one installed inside the recorder and the other separate from the recorder as a spare battery.

1. Connect the AC power adapter to an AC wall outlet.
2. Connect the battery pack to the EXT BATTERY socket of the adapter.
3. When another battery pack installed in the recorder is to be recharged simultaneously, connect the DC power output cable of the adapter to the DC IN (12 V) connector of the recorder. (The recorder should be in the Stop mode.)

4. Switch the adapter's power switch to ON. The power indicator will light red. (If the indicator lamp lights green, it means that the recorder is not in the Stop mode. Recharging is possible only in the Stop mode. Depress the recorder's STOP key.)

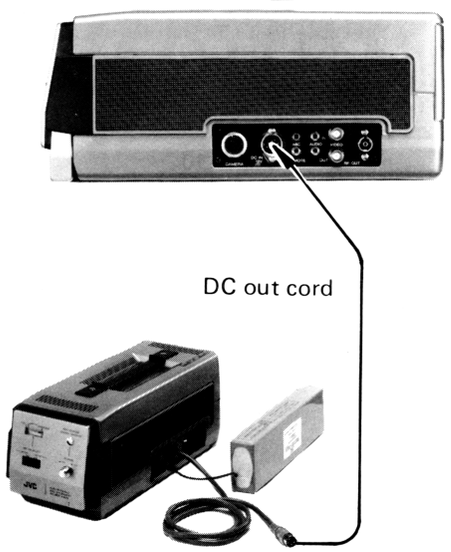



Fig. 1-13

5. Check the charging condition with the charging meter provided on the adapter.

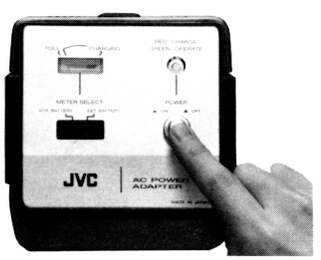



Fig. 1-14

**How to check the charging condition**

The meter needle deflects to the right when charging starts.

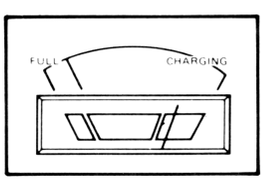



Fig. 1-15

The meter needle deflects towards the left as charging proceeds.

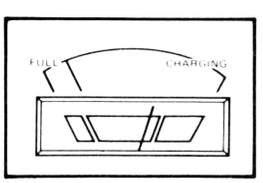



Fig. 1-16

When the meter needle points to FULL, the battery has been fully charged.

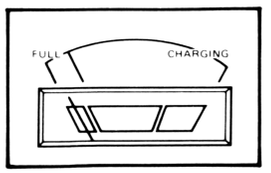



Fig. 1-17

**Meter select switch**

VCR BATTERY:
to check the charging condition of the battery pack installed in the recorder.
EXT BATTERY:
to check the charging condition of the battery pack directly connected to the AC power adapter.

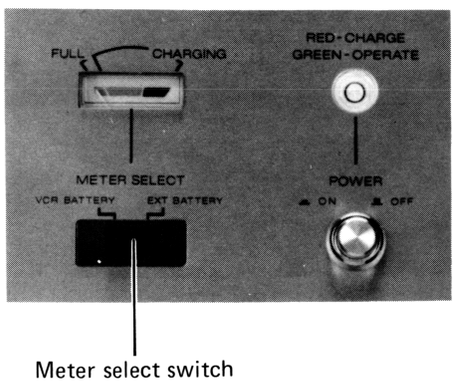



Fig. 1-18

**Note:**

- About 8 hours are required to fully charge the battery pack. However, it is recommendable to continue charging a little longer (about 10 –12 hours.)

## 1.11 POWER SUPPLY

The HR-4100E employs a convenient three-way power supply system. Select household AC current, PBP-1 battery pack or car battery according to your specific situation.

**Using the exclusive PBP-1 batter pack**

1. Loosen the screw on the battery compartment cover on the rear panel of the unit and remove the cover. Then withdraw the blue ribbon.

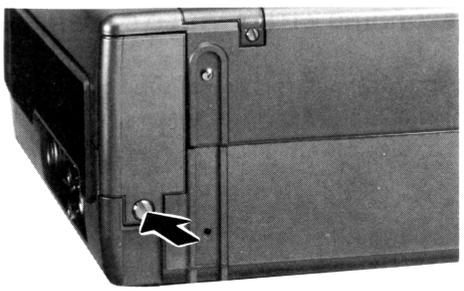


Fig. 1-19

2. Insert the battery pack with its cord forward and overlaying the blue ribbon.

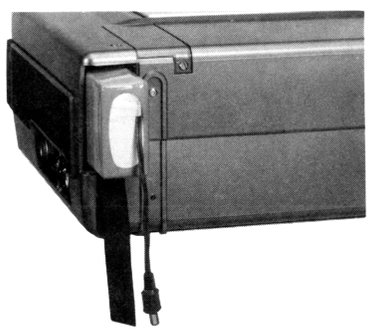


Fig. 1-20

3. Plug the battery cord into the socket near the opening and replace the cover.

| Be careful not to damage the cord and plug. |
|---|

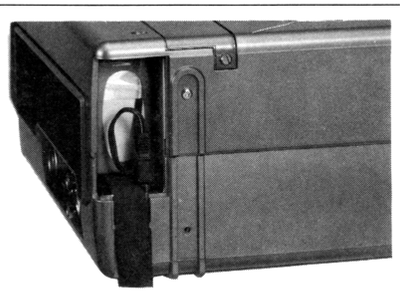


Fig. 1-21

**Using household AC with the AA-P41E AC power adapter**

1. Plug the adapter's power cord into an AC outlet.

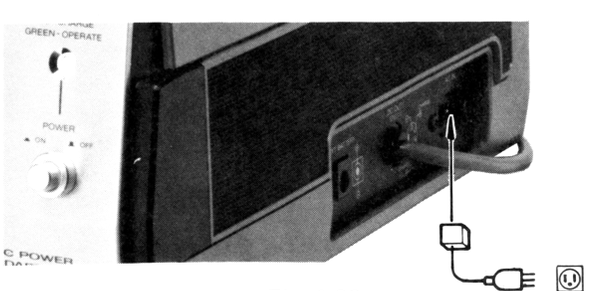



Fig. 1-22

2. Connect the adapter's DC output cord into the recorder's DC IN connector.

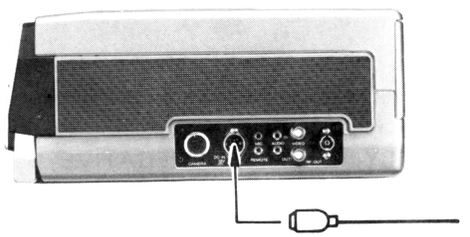


Fig. 1-23

3. Turn the adapter's power switch to ON.

| To stop power supply, be sure to put the recorder in the STOP mode first. Then turn off the adapter's power switch. |
|---|

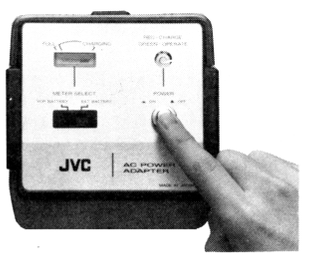



Fig. 1-24

**Using an automobile battery with the VC-3U car battery cord.**

1. Plug the car battery cord into the car's cigarette lighter socket.

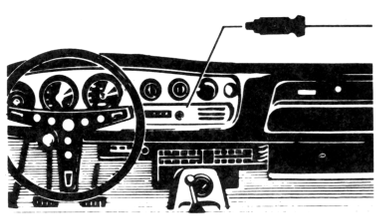


Fig. 1-25

2. Plug the other end of the cord into the recorder's DC IN connector.

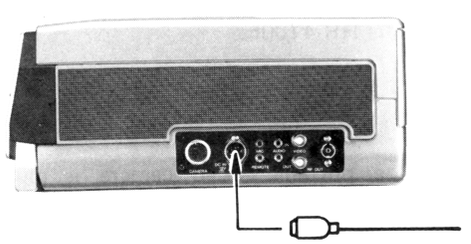


Fig. 1-26

To stop power supply, be sure to put the recorder in the STOP mode first. Then unplug the cord.

**Caution!**

- Use the car battery with the engine idling or while driving the car, to avoid discharging the car battery.
- The recorder's DC in connector should be connected ONLY to cars with NEGATIVE GROUND 12 V batteries.

## 1.12 CONNECTING TO A PORTABLE VIDEO CAMERA

The JVC GC-4100E color portable video camera or GS-1000E black/white video camera can be connected to the HR-4100E for outdoor video taping.

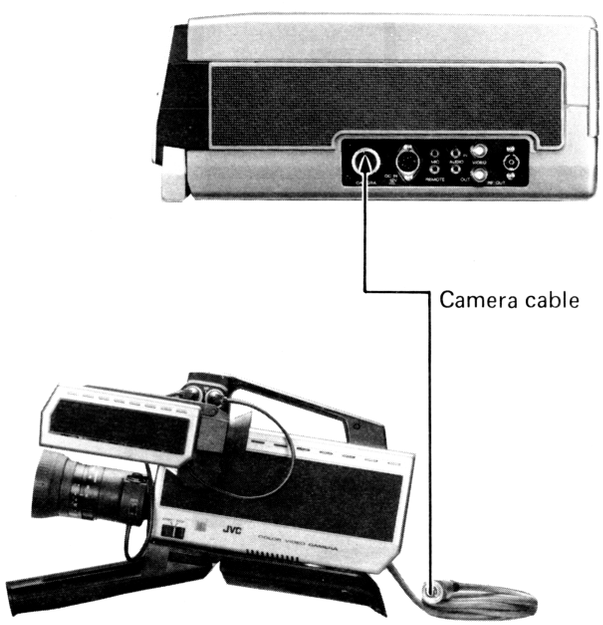



Fig. 1-27

- **Connecting to a color portable video camera**

  Connect the camera cable to the CAMERA connector of the HR-4100E.

**Note:**
When a portable video camera is plugged into the CAMERA connector, all other inputs are switched off automatically. Except MIC input.

## 1.13 RECORDING WITH A VIDEO CAMERA

1. Make preparations for power supply. (See page 1-6.)
2. Connect a portable video camera.
3. Insert a video cassette properly.

Make sure that the safety tab on the cassette is in place. If it has been broken and removed, reseal the slot with cellophane tape.

Fig. 1-29

4. Make sure that the camera's start/stop switch is in its STOP position.
   When recording with a microphone other than the camera's built-in miccrophone, connect it to the MIC jack on the HR-4100E, then the camera's built-in microphone is automatically switched off.

Fig. 1-30

5. Depress the REC and PLAY keys simultaneously.
   This also supplies power to the camera and brings both the recorder and camera in the stand-by mode in which pictures can be monitored on the camera view-finder screen without starting recording. The camera's start/stop switch must be in its STOP position.

Fig. 1-31

6. Adjust the aperture, focus and composition. (For details refer to the instructions for the camera.)

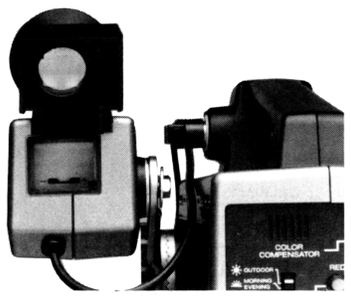



Fig. 1-32

7. Shift the camera's START/STOP switch to START. Recording will start.
   To stop recording temporarily, shift the start/stop switch to STOP to enter the standby mode.

Fig. 1-33

**Caution!**

- Do not continue holding the standby mode for more than 5 minutes. (The battery power is consumed even in the standby mode.)
- If you are going to remain in the standby mode for longer than 5 minutes, depress the recorder's STOP key.
- If the red EMPTY lamp lights, recharge or replace the battery pack immediately.
- When several cuts are shot in succession, there may be some distortion seen instantaneously at the seams between cuts during playback.

## 1.14 MONITORING THE RECORDINGS THROUGH A CAMERA VIEWFINDER

1. Make preparations for power supply. (See page1-6.)
2. Connect aportable video camera. (See page1-8.)
3. Install the prerecorded cassette properly.
4. Rewind the tape, if necessary, by pressing the REW key. To stop rewinding, press the STOP key.

Fig. 1-34

5. Depress the PLAY key.
   This permits you to view the recorded scenes on the camera's viewfinder screen.

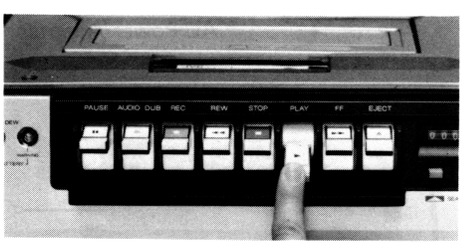



Fig. 1-35

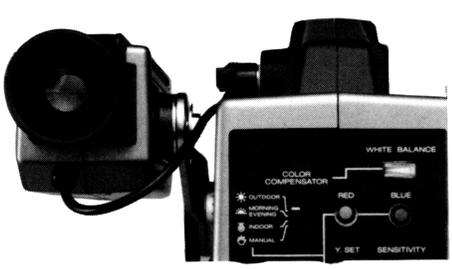



Fig. 1-36

6. If you want to monitor the recorded sound, connect the supplied earphone to the recorder's AUDIO OUT connector.

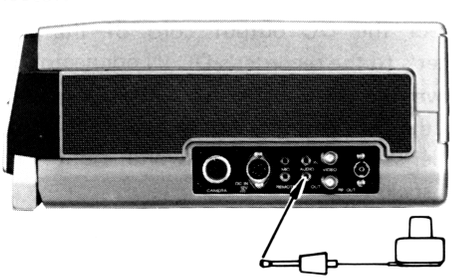


Fig. 1-37

**Caution!**

- If the red Empty lamp lights, be sure to stop the recorder and recharge or replace the battery pack.
- As long as the PAUSE key is depressed, depressing the PLAY key cannot start tape transport.

## 1.15 PLAYBACK USING A TV RECEIVER

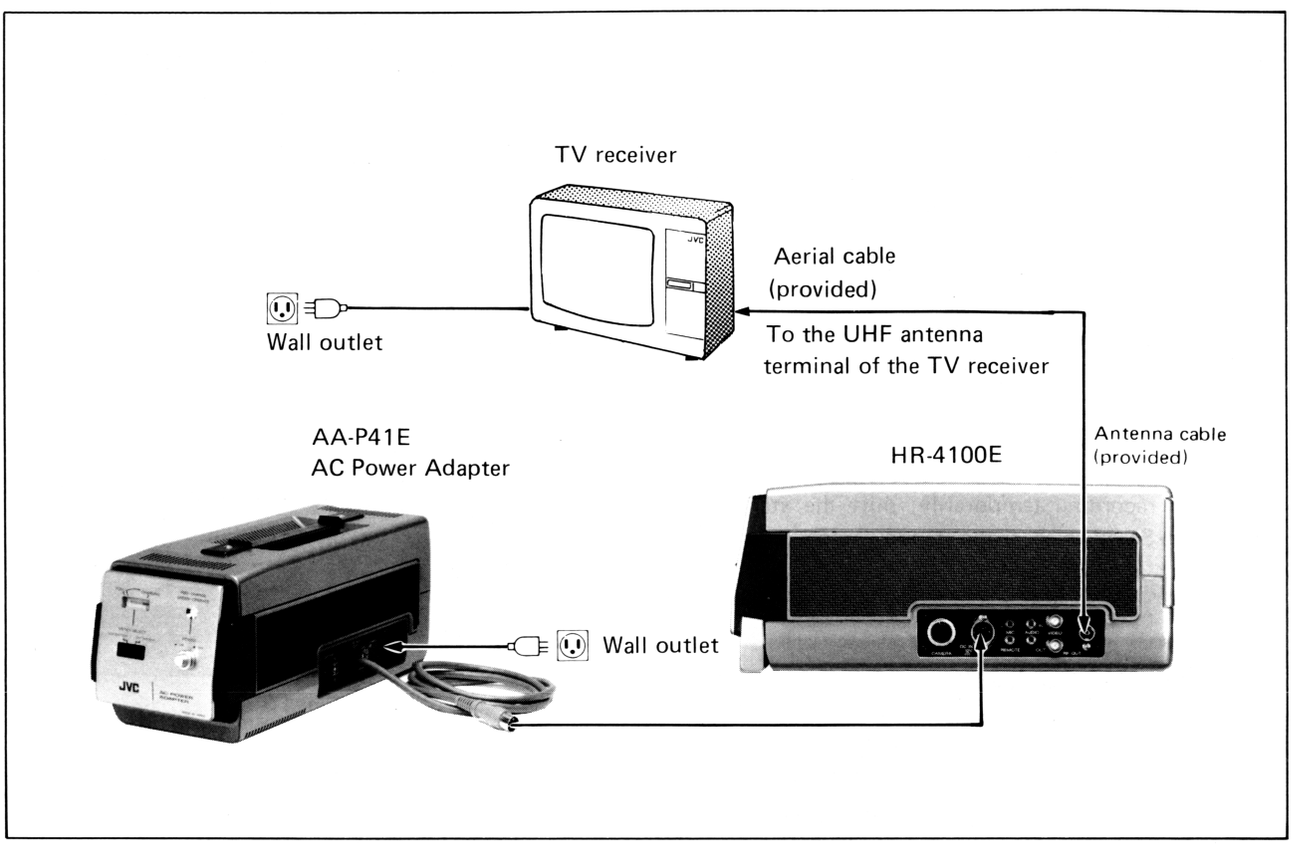



**Fig. 1-38**

An RF converter, is provided with the HR-4100E. This converter has been set to UHF channel 36 before shipment. If channel 36 is employed for broadcasting in your area, reset the converter to one of the vacant channels between 32 and 40 using a screwdriver.

**Connection**

1. Connect the power cord of the AC power adapter to an AC wall outlet.
2. Connect the DC output cord of the AC power adapter's to the recorder's DC IN connector.
3. Remove the aerial cable from the TV receiver and, using the provided aerial cable, connect between the recorder's RF OUT terminal and the TV receiver's aerial socket.

**Installing the RF converter**

1. Remove the RF converter compartment cover.

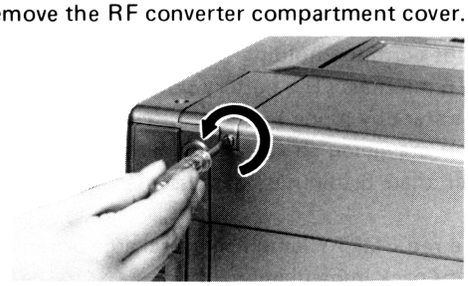


**Fig. 1-39**

2. Draw out the blue ribbon from the compartment and insert the converter into the compartment with the ribbon underneath.

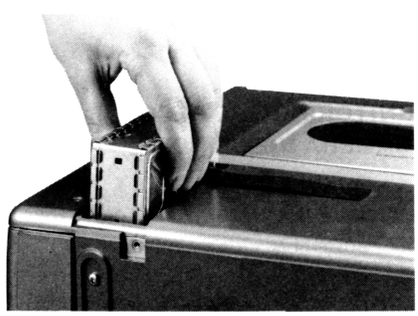


**Fig. 1-40**

The blue ribbon will make removal of the converter easier.

3. Replace the cover.

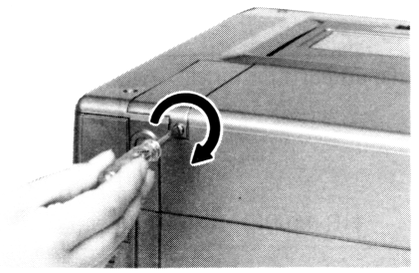


Fig. 1-41

**Playback**

1. Load the prerecorded cassette properly.

Fig. 1-42

2. Adjust the TV receiver channel selector to the same channel of the RF converter (UHF channel 32 through 40).

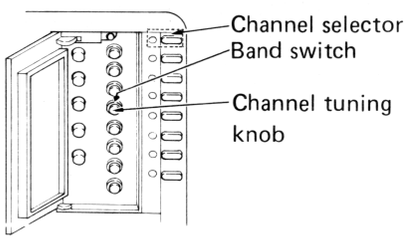



Fig. 1-43

3. Depress the PLAY key. Playback will start.

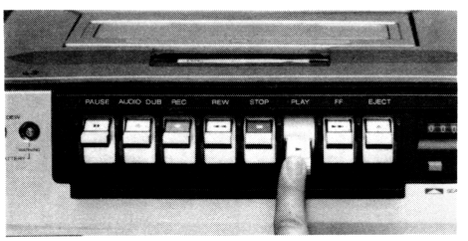



Fig. 1-44

## 1.16 AUDIO DUBBING

**Operation**

1. Turn on power for the AC adapter and TV receiver.
2. Install the RF converter as described before.
3. Set the TV receiver channel properly.

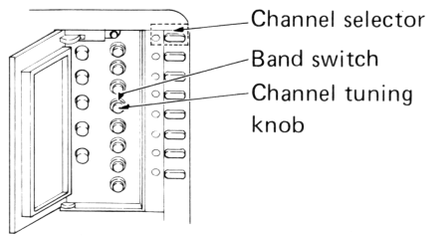



Fig. 1-45

4. Load the prerecorded cassette properly.

Fig. 1-46

5. Depress the AUDIO DUB and PLAY keys simultaneously.
6. While monitoring the TV screen, perform microphone recording.

The prerecorded sound track is replaced with the new recordings.

Fig. 1-47

**Caution!**

- **If the AUDIO DUB key cannot be depressed. . .**
  Check the safety tab on the cassette. If the safety tab has been removed, audio dubbing is impossible. Reseal the slot with cellophane tape.
- **If howling is heard from the TV receiver. . .**
  Turn the TV volume control down or move the microphone away from the TV receiver.

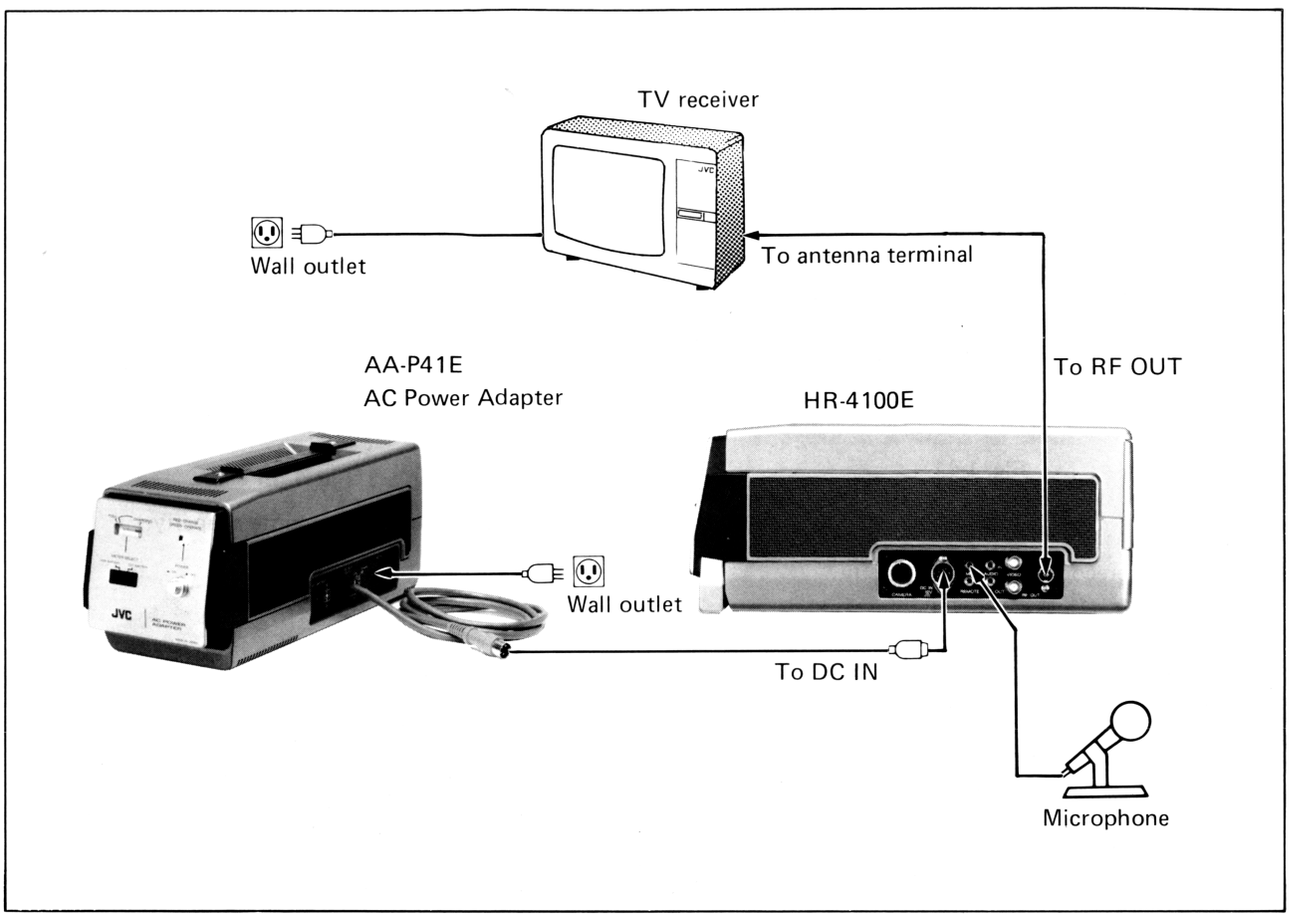



Fig. 1-48

## 1.17 RECORDING AND PLAYBACK USING A COLOR TV MONITOR

### Recording

1. Switch the AC power adapter ON.
2. Load a cassette properly into the recorder.
3. Switch the color TV monitor ON and set its TV/VTR select switch to VTR.

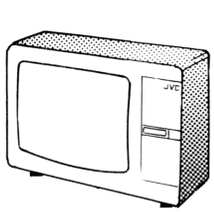


Fig. 1-49

4. Set the TV monitor channel selector to the channel which you wish to record.
5. Depress the REC and PLAY keys simultaneously. Recording will start. To stop recording, depress the STOP key.

Fig. 1-50

### Playback

1. Rewind the tape by depressing the REW key. To stop rewinding midway, depress the STOP key.

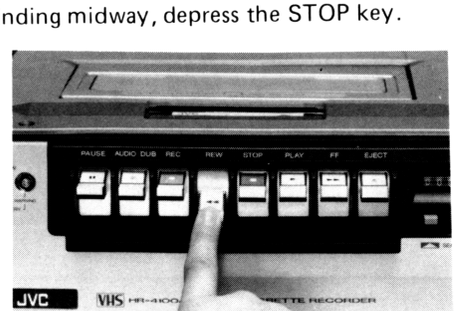



Fig. 1-51

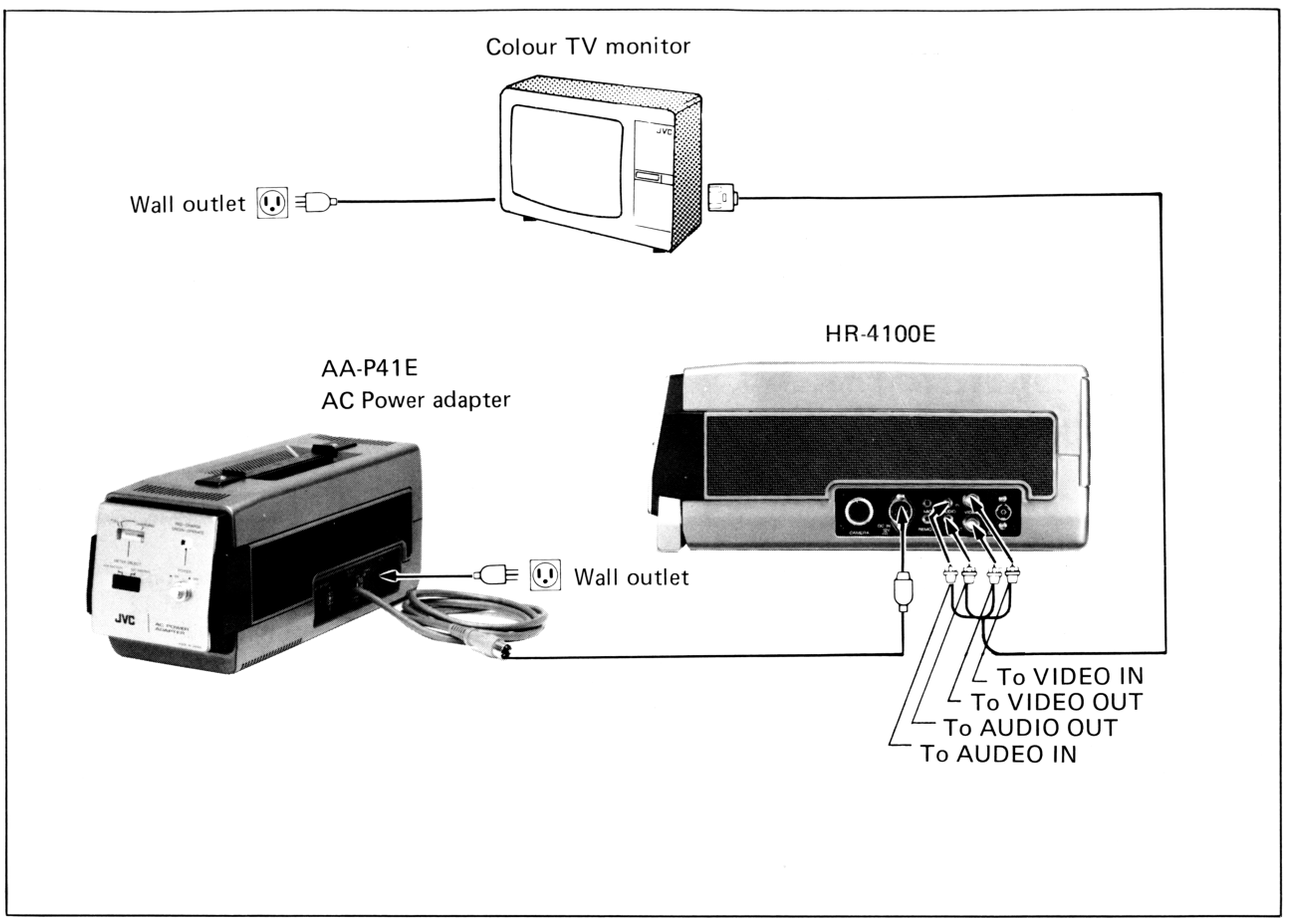



Fig. 1-52

2. Depress the PLAY key. The recorded program will be reproduced on the TV monitor screen.

Fig. 1-53

**Caution!**

- The video and audio input teminals can be used only when the CAMERA connector is free. When a camera is connected to the CAMERA connector, only the signals from the camera can be recorded.

- As long as the PAUSE key is depressed, the PLAY key does not function.

## 1.18 CONVENIENT FACILITIES

**SEARCH button**

1. When you start recording or playback in the middle of the cassette, press the counter reset button to reset the counter to "000".
2. To return to that point of starting after recording or playback, first press the SEARCH button for ON and then depress the REW key. The tape will stop automatically just before that point; i.e. when the counter reaches "999".

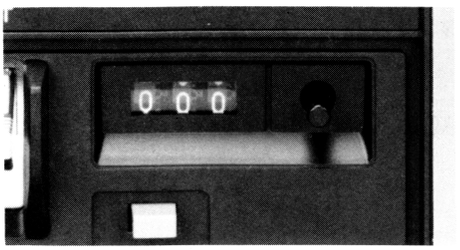



Fig. 1-54

**Note:**
The SEARCH button functions only in the Rewind mode.

**PAUSE key**

For skipping unpreferred material:
Depress the PAUSE key if you wish to stop the tape temporarily during recording or playback.

Fig. 1-55

Convenient for skipping commercials during recording TV programs.

For recording a program on a part of the prerecorded tape:

1. Play back the tape and locate the point from which you wish to start a new recording.
2. Depress the PAUSE key.
3. Depress the REC key and release the PAUSE key. This permits you to record the new program immediately following a previously recorded program.

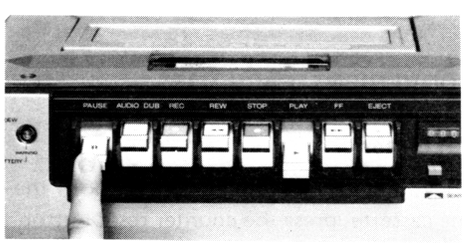


Fig. 1-56

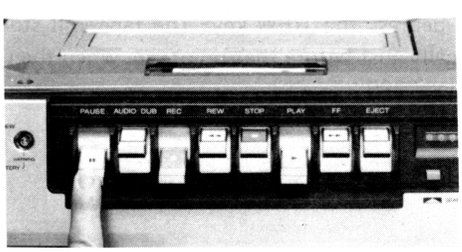


Fig. 1-57

The Pause function can be controlled with a remote control switch (optional).

**Note:**
When the tape is stopped with the PAUSE key during recording, the playback picture may become distorted for a moment. However, this is normal and a clear picture will soon return.

**Pause remote control**

The pause function can also be controlled with the optional remote control switch RM-42 connected to the side panel REMOTE jack.

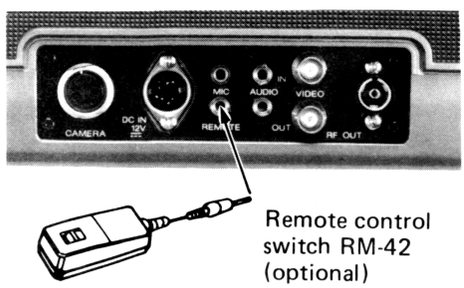



Fig. 1-58

**PRECAUTIONS FOR THE PAUSE MECHANISM**

The built-in pause mechanism functions to stop the tape temporarily in the Record and Play mode. This pause mechanism is activated by either of the following three operations:

- When the PAUSE key is pressed during recording or playback.

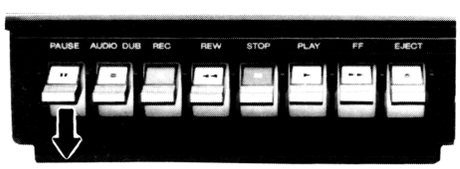



Fig. 1-59

- When the camera's start/stop switch is pressed to STOP if the HR-4100E is being used in combination with the JVC portable video camera GC-4100E.

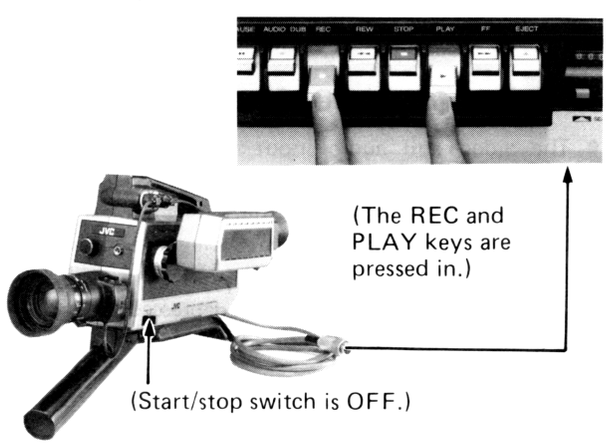
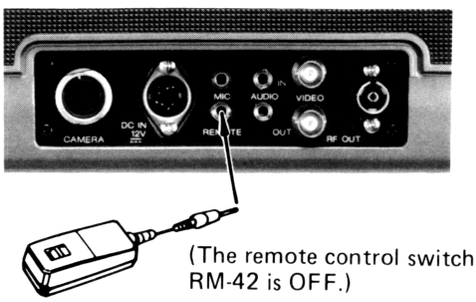



Fig. 1-60

- When the pause remote control switch RM-42 is turned OFF during recording or playback if the remote control switch is connected to the REMOTE jack.




(The remote control switch RM-42 is OFF.)

**Fig. 1-61**

**CAUTION!**

Do not remain in the Pause mode longer than 5 minutes. If you are going to stop the tape for a longer period than 5 minutes, press the STOP key. (The battery will discharge even in the Pause mode.)

# SECTION 2
# MECHANISM

## 2.1 GENERAL

The video cassette recorder "VHS" does not require tape to be manually threaded as with an open-reel type video tape recorder.

Instead, a special action for automatically loading and unloading tape is provided. Each operation of this "VHS" other than insertion or removal of the cassette is controlled by one key, except record, which for prevention of accidental erasure, requires two keys to be depressed. This means, pressing any one of the control keys sets up the mechanism to control all the assemblies used in that mode.

In addition, to prevent damage to the tape or the "VHS" it is necessary to go to STOP when switching one mode to another.

The main actions of the "VHS" mechanism are described below.

## 2.2 BASIC ACTION

### 2.2.1 Inserting and removing the video cassette

When the EJECT key is pressed, the cassette housing is lifted upward so the cassette can be easily loaded. Insert the cassette into the cassette housing completely. Then push the cassette cover downward by hand.
When removing a cassette, make sure the unit is in the Stop mode.

### 2.2.2 STOP to PLAY (loading)

Insert the video cassette and press the PLAY key. At that time, tape is pulled out from the cassette for loading. After tape loading is finished, the tape starts traveling and a playback picture appears on the TV monitor. As shown in Fig. 2-1(a), tape is pulled from the supply reel and take-up reel during loading. After the tape tape starts traveling, it is wound onto the take-up reel disk, while being pulled from the supply reel, as shown in Fig. 2-1(b).

**Note:** During the PAUSE key is depressed, the PLAY key does not function.

### 2.2.3 PLAY to STOP (unloading)

When the STOP key is pressed, the PLAY key is released from the lock. A fraction of a second later, unloading starts. During the unloading mode, the tape is wound onto the supply reel.

### 2.2.4 STOP to REW (Rewind mode)

When the REW key is pressed, the rewind mechanism is locked by the function mechanism. At the same time tape is rewound from the take-up reel to the supply reel as shown in Fig. 2-2. By pressing the STOP key to stop the tape the REW key is released from the lock.

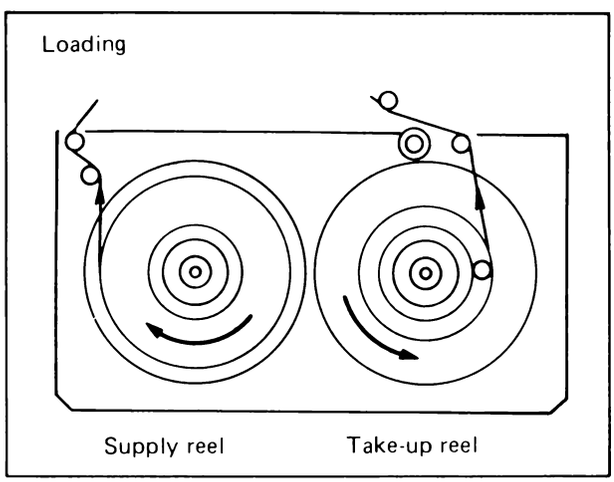



**Fig. 2-1(a)**

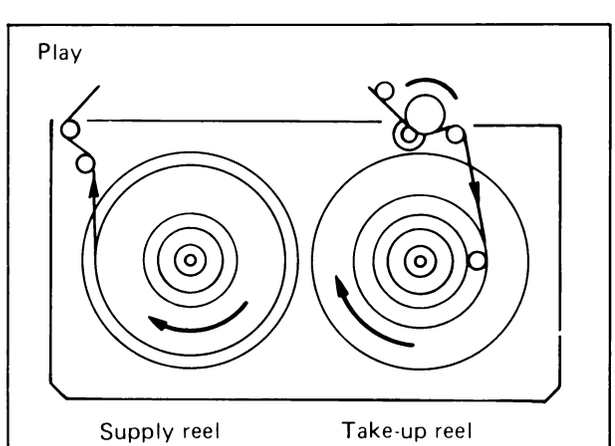



**Fig. 2-1(b)**

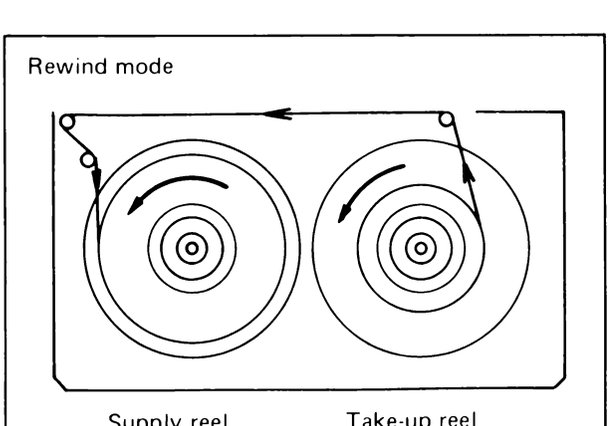



**Fig. 2-2**

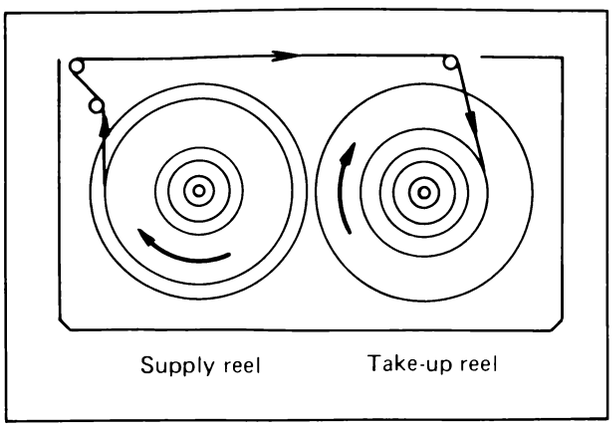



**Fig. 2-3** F.F. mode

### 2.2.5 STOP to F.F. (Fast forward mode)

When the F.F. (fast-forward) key is pressed, it is held by the function mechanism. At the same time, tape is rapidly wound from the supply reel to the take-up reel as shown in Fig. 2-3. Pressing the STOP key stops the tape and the F.F. key is released.

### 2.2.6 PAUSE mode

The tape traveling is stopped when the PAUSE key is pressed in Play or Record mode.

In Pause mode, the mechanism actions are the same as in Record mode, except that the pinch roller is released from the capstan shaft and the take-up idler is released from the reel disk, so that tape traveling is stopped.

In Still mode, the mechanism actions are the same as in Play mode, except that the capstan DC motor is stopped, so that tape traveling is stopped.

When the PAUSE key is pressed again, the tape starts traveling again.

### 2.2.7 Automatic stop system (photo transistor operation)

Automatic stop is initiated when the photo transistor operates at the beginning or end of the tape in Play/Record, Rewind or Fast Forward mode.

1. As shown in Fig. 2-4(a), when rewinding to the beginning of the tape, the beam from the cassette lamp reaches the start sensor (photo transistor) through the clear leader tape, and the unit will stop automatically. Also, when clear leader is already present, the Rewind mode will not operate.

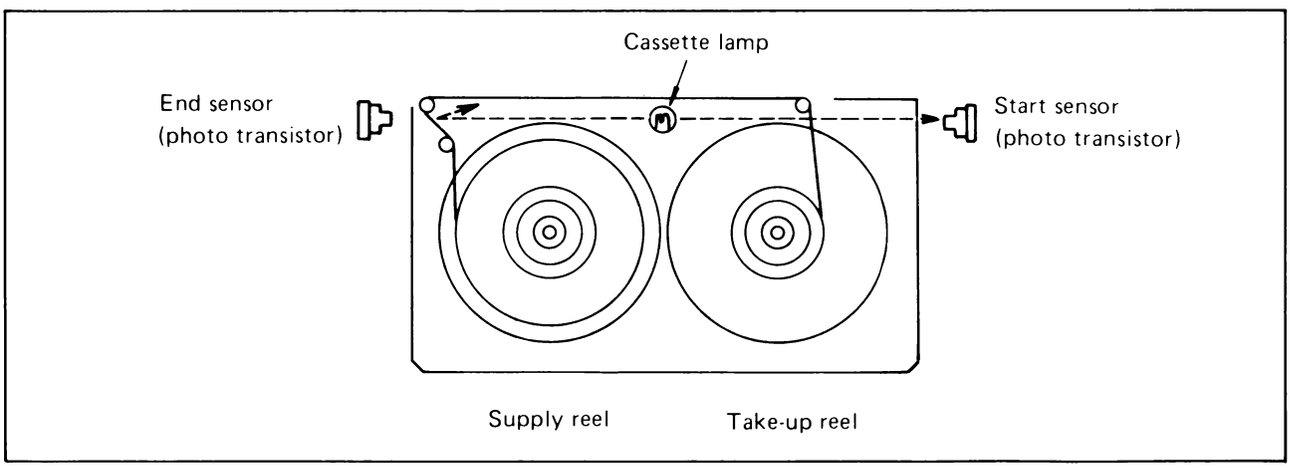



**Fig. 2-4(a)** Beginning of the tape

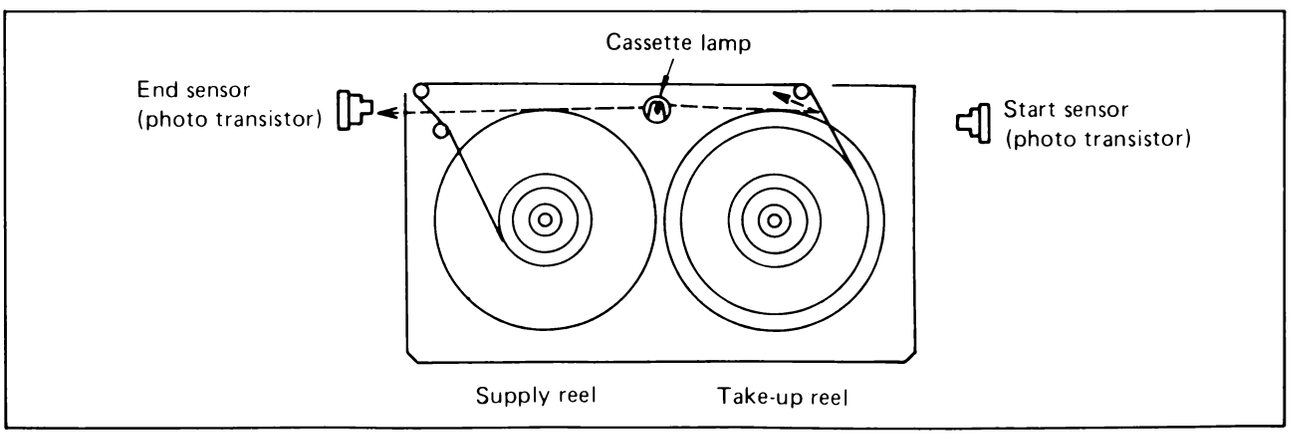



**Fig. 2-4(b)**

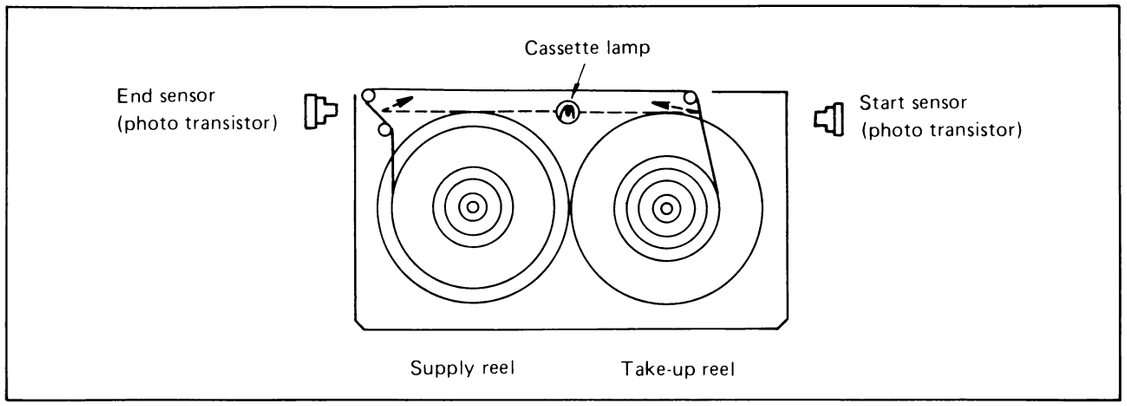



**Fig. 2-4(c)**

2. As shown in Fig. 2-4(b), when the light beam from the cassette lamp reaches the end sensor when in the Play/Record or Fast Forward mode, the unit will be stopped automatically. Also, when the light beam shines on the end sensor (photo transistor), Play/Record or Fast Forward modes will not operate.
3. When the light beam is interrupted by the video tape as shown in Fig. 2-4(c), all modes are available by pressing the corresponding key.
4. When the take-up reel disk rotation is stopped in Play or Record mode, the light beam is interrupted by the video tape as shown in Fig. 2-4(d), the unit will be stopped automatically.

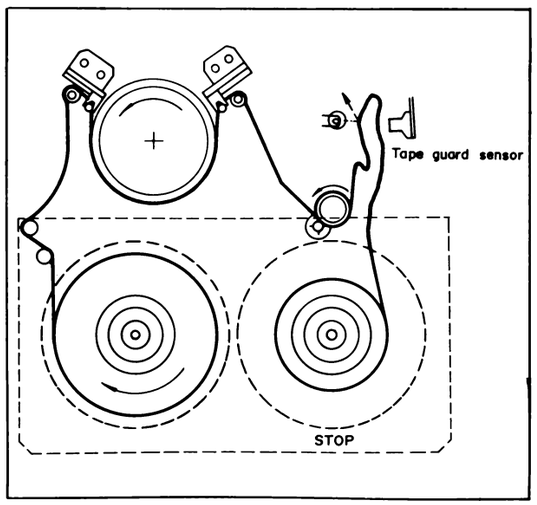



**Fig. 2-4(d)**

## 2.3 FUNCTION OF MAIN COMPONENTS

### 2.3.1 Capstan motor

Refer to Fig. 2-5.

The capstan motor is a DC motor, which is controlled at a constant speed by a servo circuit. The rotation of the capstan motor is transmitted to the relay pulley, via the relay belt, and the relay pulley rotation is transmitted to the capstan flywheel via the capstan belt. On the other hand, the rotation of the relay pulley is transmitted to the rewind idlder and the take-up idler via the reel drive belt, and the rotation of the rewind idler is transmitted to the unloading idler via the unloading idler belt. In short, all the above operations are made by the DC capstan motor. The capstan motor powers all the driving system such as the capstan shaft, take-up reel disk, and so forth.

### 2.3.2 Drum motor

As shown in Fig. 2-5, the rotation of the drum motor is transmitted to the drum pulley via a belt. The drum motor's rotation is controlled by the servo circuit.

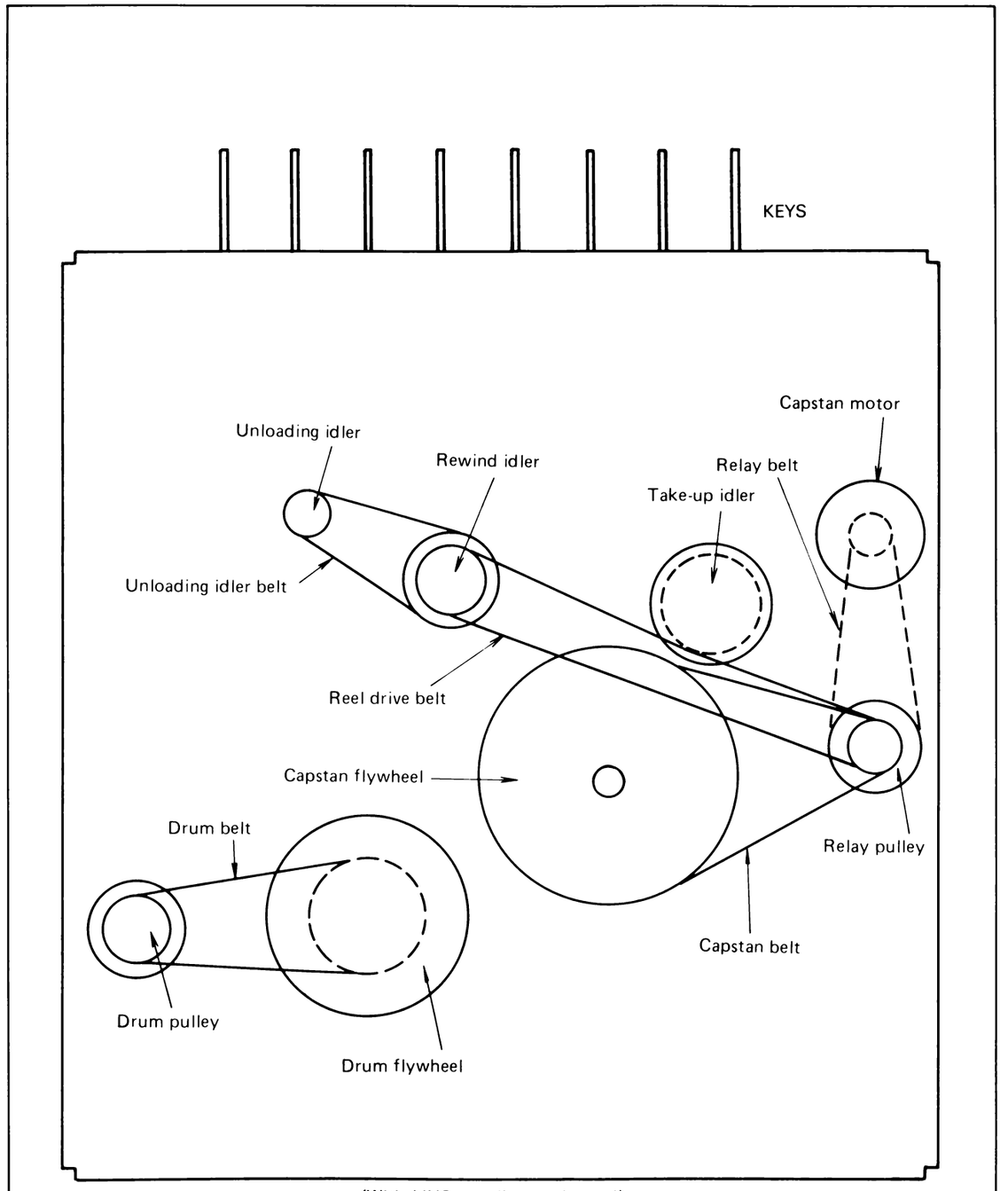
### 2.3.3 Stop solenoid

When the automatic stop system operates, the stop solenoid operates to release the function keys.

### 2.3.4 Pinch roller solenoid

The pinch roller solenoid operates in all modes other than Stop and Pause, and performs the following functions:

1. Presses the pinch roller ass'y against the capstan shaft.
2. Presses the take-up idler ass'y against the take-up reel disk.
3. Removes the brake from the take-up and supply reel disks.




(With VHS standing on its end)

**Fig. 2-5** DC motor drive mechanism

## 2.4 LAYOUT OF MAIN MECHANICAL AND ASSOCIATED PARTS
### — TOP VIEW —

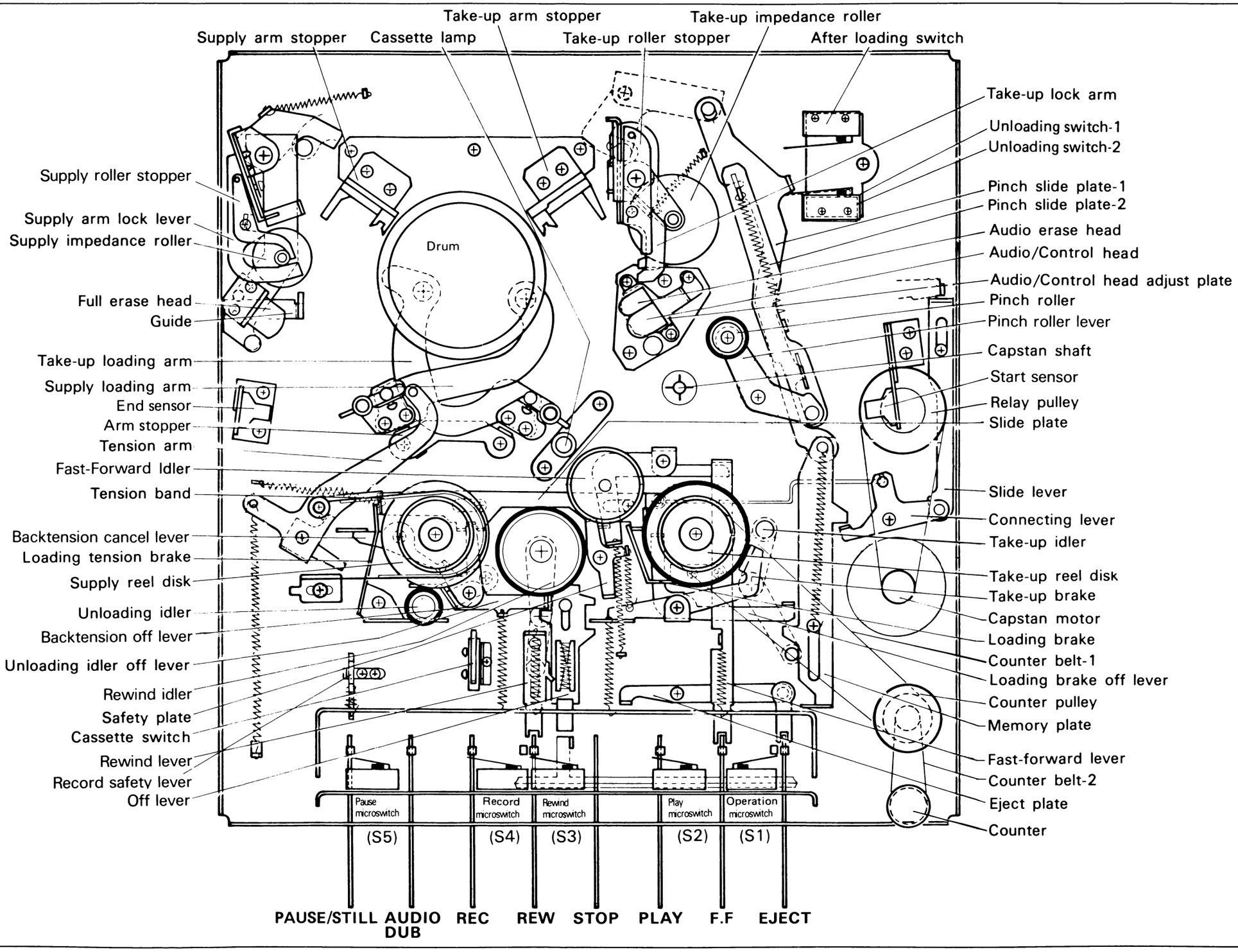



**Fig. 2-6 (a)** STOP mode mechanism (TOP VIEW)

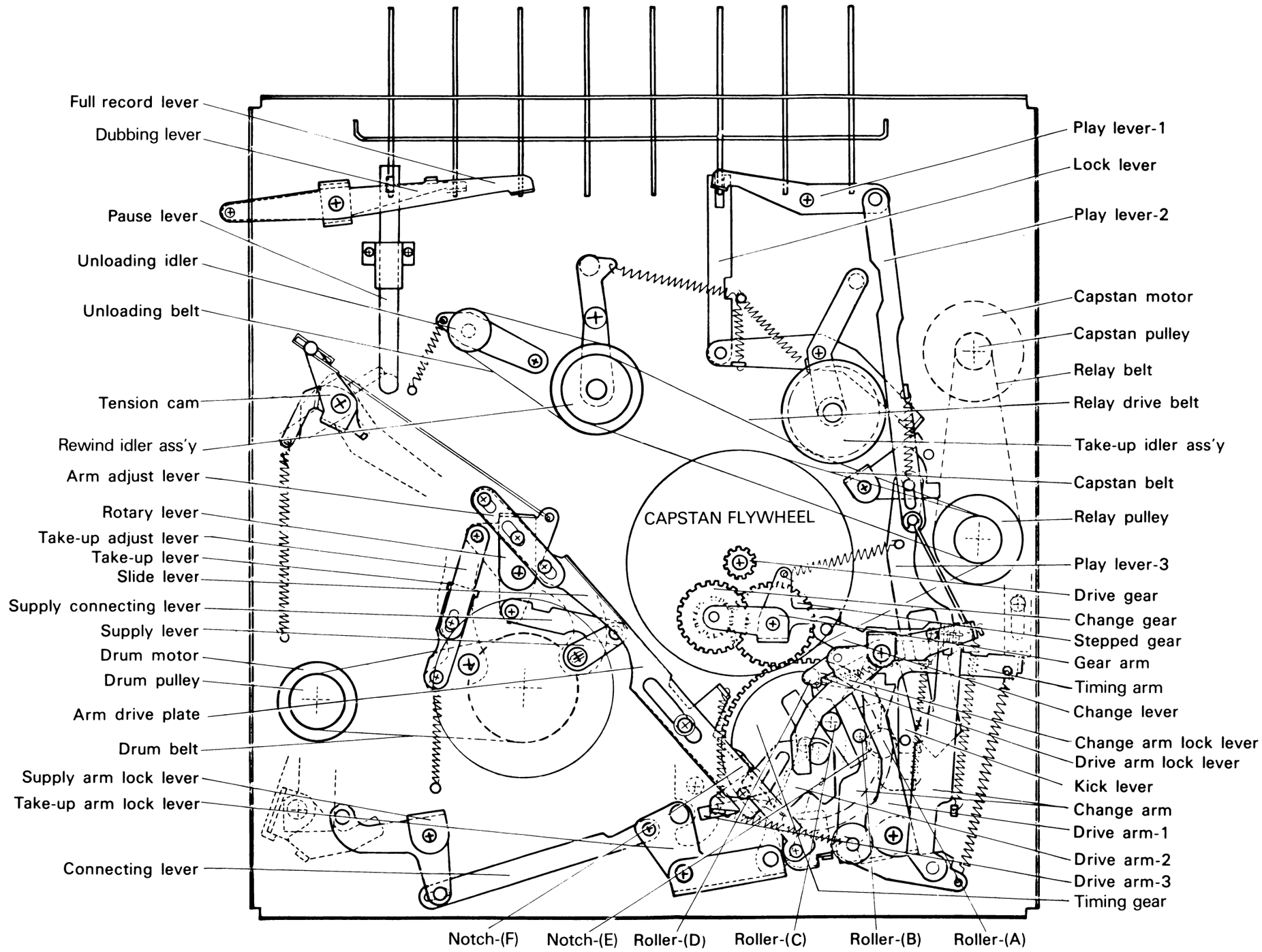



**Fig. 2-6 (b)** Stop mode mechanism (BOTTOM VIEW)

## 2.5 STOP MODE MECHANISM

Refer to Fig. 2-6(a), (b).
Stop mode means the condition in which no manual keys are pressed, and the supply loading arm and the take-up loading arm are in the stop position, with the unloading switches pressed (on position). Also, the unloading idler is pressed to the supply reel disk and the take-up brake affects the take-up reel disk. Capstan and drum motors are stopped.

When the unit is in this condition, it is possible to press the EJECT key and to load or unload a cassette.

## 2.6 LOADING-1 MECHANISM

When pressing the PLAY key after being in the Stop mode, the play lever-1, 2, 3 moves to arrows (a), (b), (c) as shown in Fig. 2-7.

By this pulling action of the play lever-3, the downward stud (D) on the change lever is pulled up at the top of the groove of the play lever-3, then the change lever is turned counterclockwise (d). As a result, the gear arm becomes free and starts rotation clockwise (e) being pulled by the force of the spring-2, then the change gear is pressed to the drive gear on the capstan shaft.

Accordingly, the rotation of the capstan motor is transmitted via a belt to the following, Capstan motor — Relay pulley — Capstan flywheel, Drive gear and change gear — Stepped gear — Timing gear.

In short, when the drive gear contacts with the change gear, the timing gear starts rotation clockwise. By this clockwise rotation, the roller (A) which is fixed on the timing arm and has been set in the notch (F) of the timing gear runs on edge of the timing gear. At this time, the timing arm moves to arrow (g) by the rotation of the timing gear; then the timing arm is locked by the edge of the timing gear.

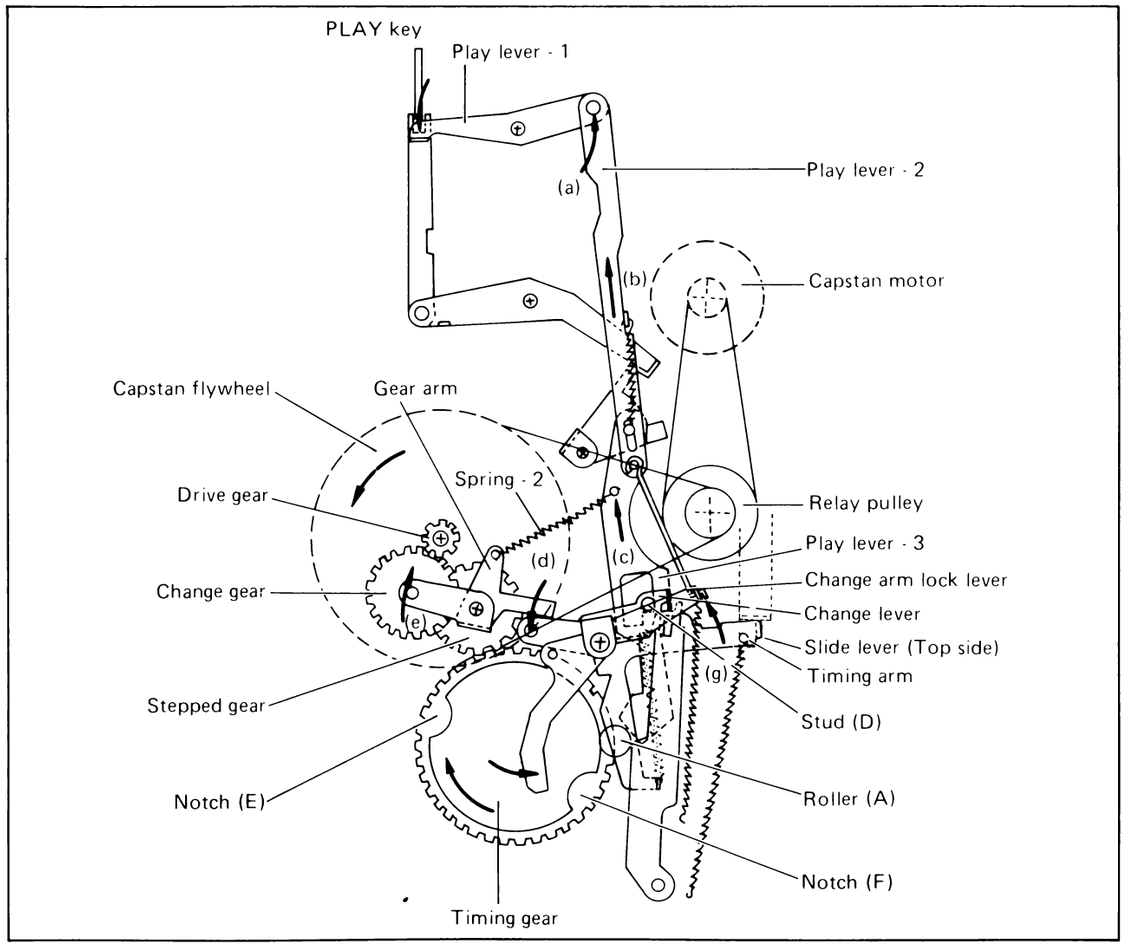



**Fig. 2-7** Loading-1 mechanism (Bottom view)

By the pulling action of the play lever-3, namely the Gear arm rotates as arrow (e) by the force of spring-2, so that the change gear contacts with the drive gear; then the timing gear starts clockwise rotation. However, the change arm lock lever moves to arrow (g) by the pulling action of the play lever-2 through the rod.

After that the timing gear continues its clockwise rotation.

Refer to Fig. 2-8 Loading-1 mechanism (Top view).

When the manual PLAY key is pressed, the play switch and operate switch are turned on, so that the capstan DC motor and drum DC motor both start rotation. Also, the pinch roller solenoid is energized as a result. It removes the brake from the take-up and supply reel disks as shown in Fig. 2-17. At the same time, the off lever moves to arrow (a) by the function mechanism, so that the unloading idler releases from the supply reel disk by the movement of the unloading idler off lever, also the loading tension brake supplies to supply reel disk and the take-up brake releases from the take-up reel disk.

However, by the timing arm movement located in bottom side, see Fig. 2-7, the slide lever moves to arrow (e) and the connecting lever, memory plate and pinch roller slide plate-1, -2 moves to arrows (f), (g), (h) as shown in Fig. 2-8, so that the pinch roller and the take-up roller stopper mechanism moves to arrows (i), (k) for stand-by position. At this time, unloading switches-1 and -2 are in the off position.

Also, the slide plate moves to arrow (j) by the clockwise rotation (f) of the connecting lever, so that the loading tension brake and loading brakes supplies to the supply reel disk and the take-up reel disk. Also, the safety plate moves to arrow (e) to lock the off lever by the force of a spring.

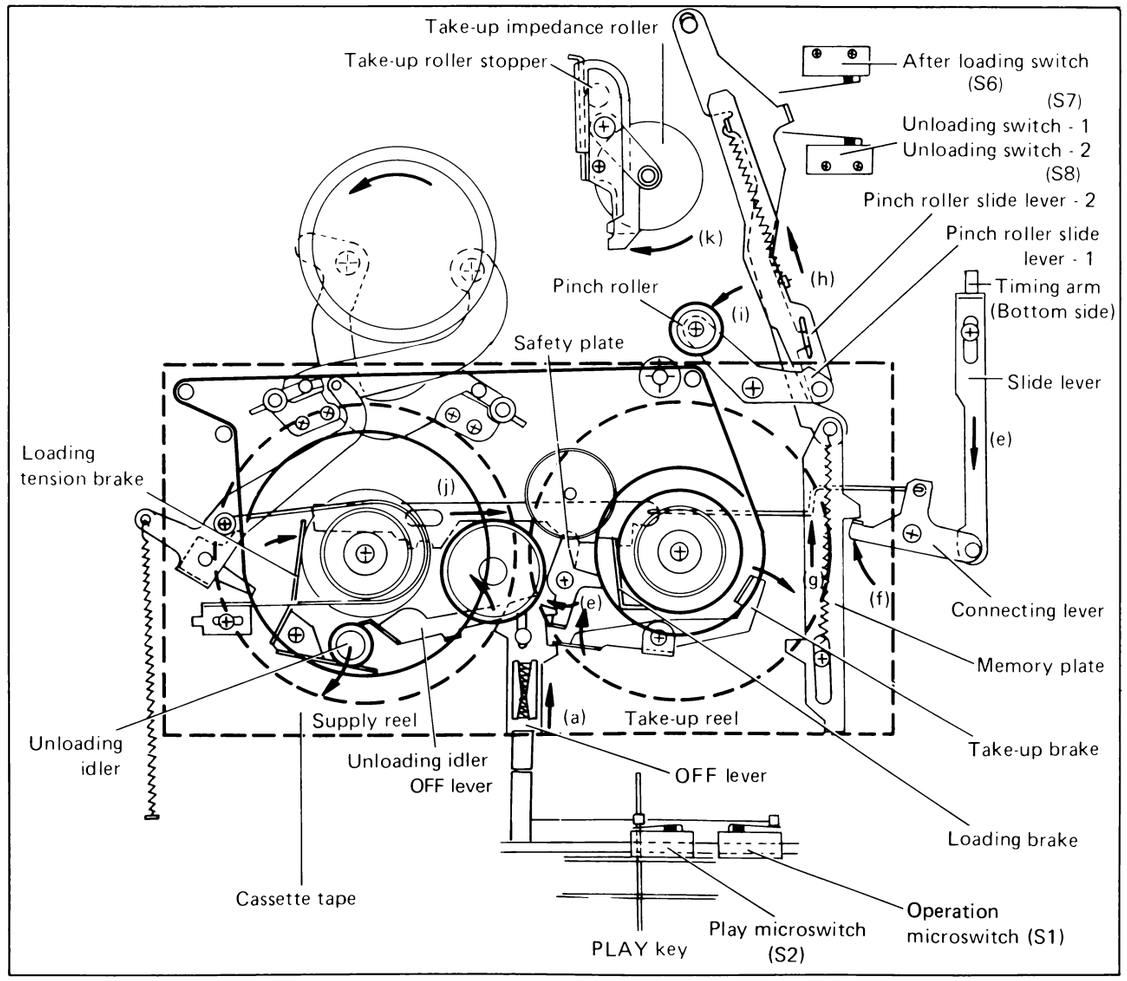



**Fig. 2-8** Loading-1 mechanism (Top view)

## 2.7 LOADING-2 MECHANISM

Refer to Fig. 2-9, Loading-2 mechanism (Bottom view). Corresponding to the clockwise rotation (a) of the timing gear, the roller (C) fixed on the timing gear also makes clockwise rotation.

By this rotation of the roller (C), the drive arm is moved to arrow (b) and the change arm-1 and -2 also rotates counterclockwise (c) being pulled by the force of the spring connected with the timing arm. However, the rotation of the change arm-1 and -2 stops at the point that the roller (B), also fixed on the change arm-2, touches the change arm lock lever.

On the other hand, by the rotation of the roller (C), as shown in Fig. 2-10, namely the counterclockwise movement of the drive arm, the arm drive plate connected with the drive arm moves to arrow (d) and also the slide lever is pulled toward to arrow (d). Accordingly, the rotary lever starts clockwise rotation (e). By the clockwise rotation of the rotary lever, the take-up loading arm lever moves to arrow (f) and the take-up loading arm starts rotation clockwise to pull the video tape from the cassette. At the same time, also the supply loading lever rotates counterclockwise (g) and the supply loading arm pulls the video tape from the cassette. By the clockwise rotation of the rotary lever, the tension arm cam rotates counterclockwise (h) by the pulling action of the rod. This frees the tension cam, which has locked the tension arm.

In short, the loading arm and the tension arm start operation by the movement of the drive arm.

As shown in Fig. 2-10, the rotary lever rotates clockwise (e) by the movement of the drive arm. As a result, the supply loading arm and the take-up loading arm are moved to arrows (a), (b) as shown in Fig. 2-11. Also, the tension arm is made free by the movement of the tension cam on the bottom side, and the tension arm rotates counterclockwise (c) by the force of the spring until the tension arm contacts with the backtension cancel lever. At this time, the backtension is not furnished to the supply reel disk. As the result, video tape is pulled from the cassette by the supply and take-up loading arm.

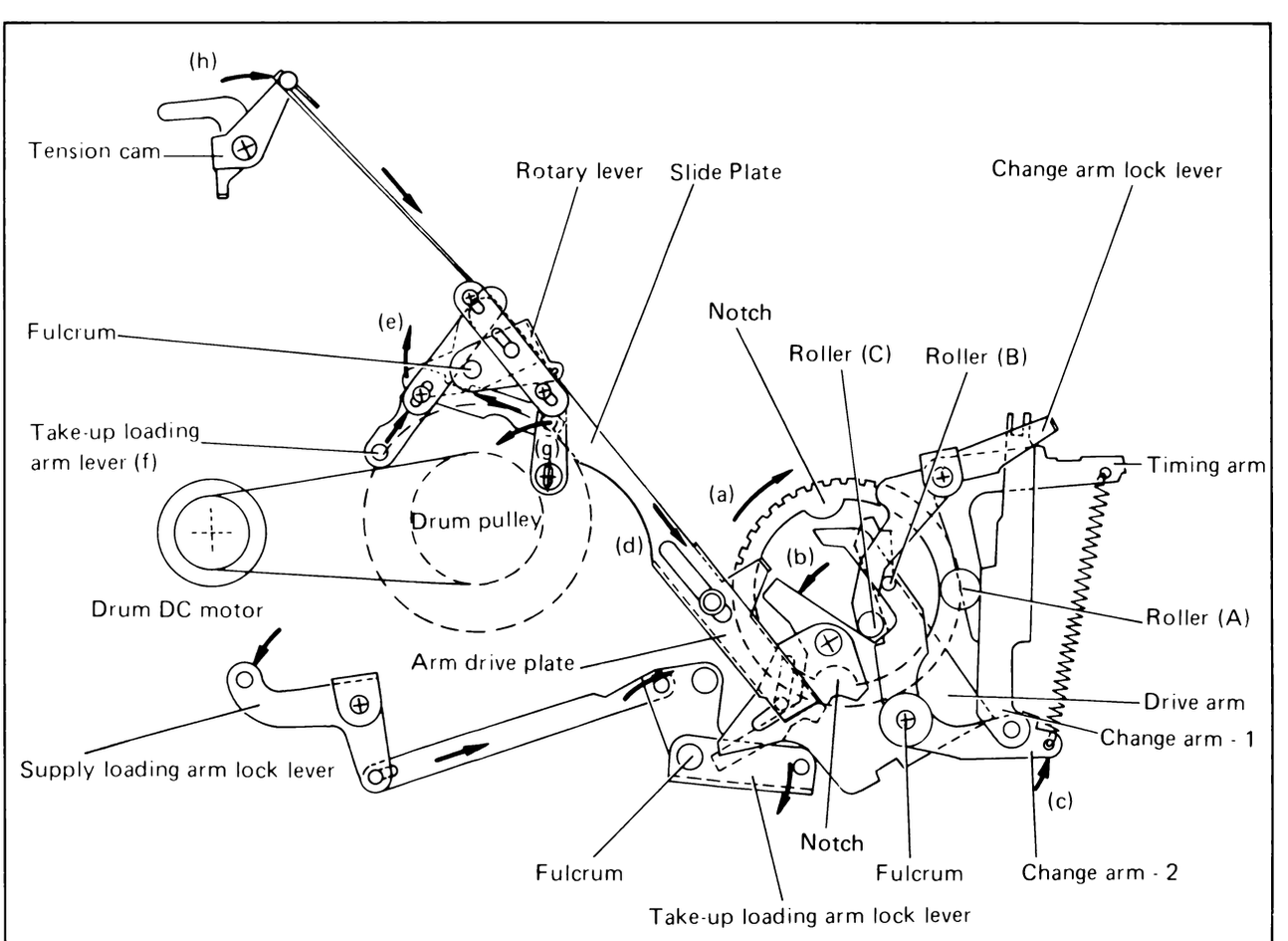



**Fig. 2-9** Loading-2 mechanism (Bottom view)

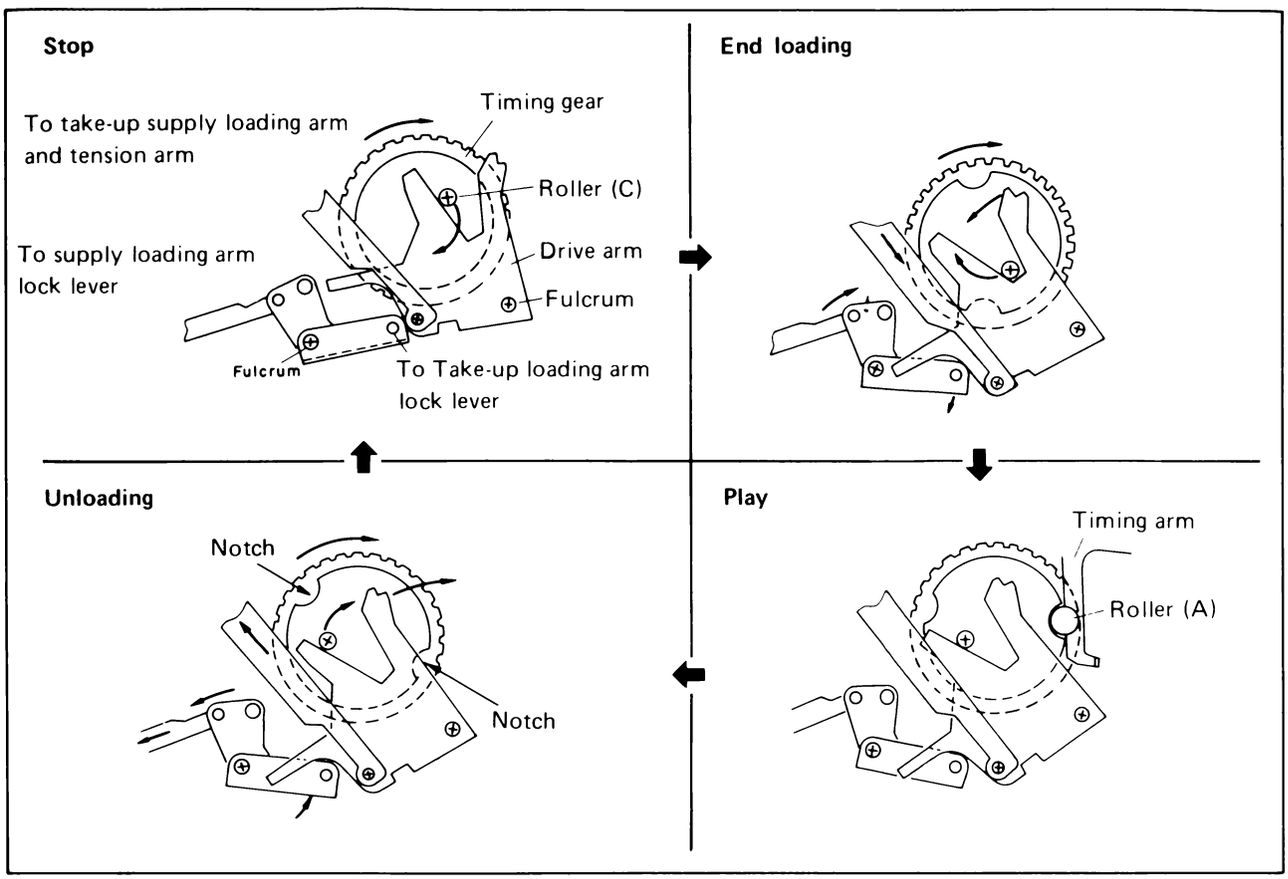



**Fig. 2-10** Loading and Unloading

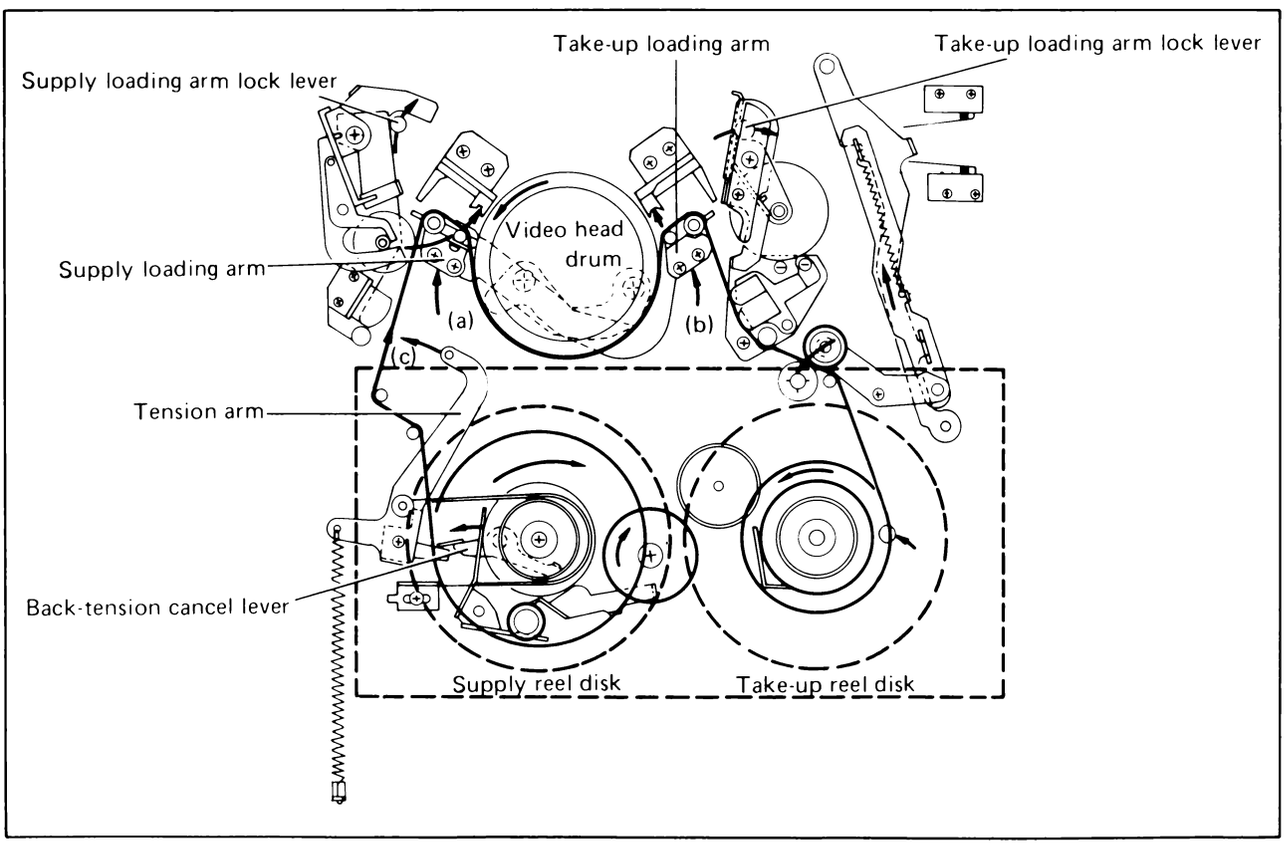



**Fig. 2-11** Loading-2 mechanism (Top view)

## 2.8 PLAY MODE MECHANISM

Refer to Fig. 2-12, Play mode mechanism (bottom view). By the rotation of the roller (C) on the timing gear, the drive arm moves to arrow (d) and the arm drive plate is pulled to arrow (e).

When the loading arm reaches to the loading end, the movement (d) of the drive arm is effective only to the drive arm plate, and the take-up loading arm lock lever. In this time, the movement of the loading arm stops. On the other hand, by the rotation of the drive arm, the take-up loading arm lock lever turns clockwise (f) to lock the take-up loading arm, and the supply loading arm lock lever turns counterclockwise to lock the supply loading arm. By the rotation of the take-up loading arm lock lever, the pinch slide plate operates and the pinch roller is pressed to the capstan shaft.

When the drive arm reached to the almost fully counter-clockwise position of the drive arm movement by the roller (C) fixed on the timing gear, the stud fixed on the bottom of the timing gear kicks the kick lever counter-clockwise (g). Then the kick lever pushes the play lever-3 to arrow (g). As a result, the stud of the change lever will be free from the locking on the upper side of the play lever-3 groove, so that the change lever is ready to move in the direction of arrow (i).

On the other hand, when the drive arm reaches almost fully counterclockwise position of the drive arm movement, the drive arm lock lever fixed on the change arm lock lever will be free and pulled counterclockwise (h) by the spring. Corresponding to the rotation of the timing gear and the roller (C), the drive arm is locked by the roller (D) of the drive arm lock lever. Then, the roller (A) of the timing arm goes into the notch (E) of the timing gear. By this operation, the change lever becomes free, and starts rotation to arrow (i) by the force of spring. At this stage, loading is completed and the machine assumes Play mode.

Refer to Fig. 2-13, Play mode mechanism (Top view). By the movement of the drive arm, the loading arm starts to load. When the loading arm reached loading end, the take-up arm stopper and the supply arm stopper moves as arrows (a), (b) by the rotation of the drive arm through the take-up loading arm lock lever and the supply loading arm lock lever (bottom side). As the result, the loading arm is locked at the arm stopper. And also, corresponding to movement of the supply arm stopper, the full-erase head and the guide pole are moved to the Play mode position. At this time, tape traveling is determined by the edge of the guide pole.

On the other hand, by the movement of the take-up loading arm lock lever, the pinch roller slide plate-2 connected with the pinch roller slide plate-1 by the

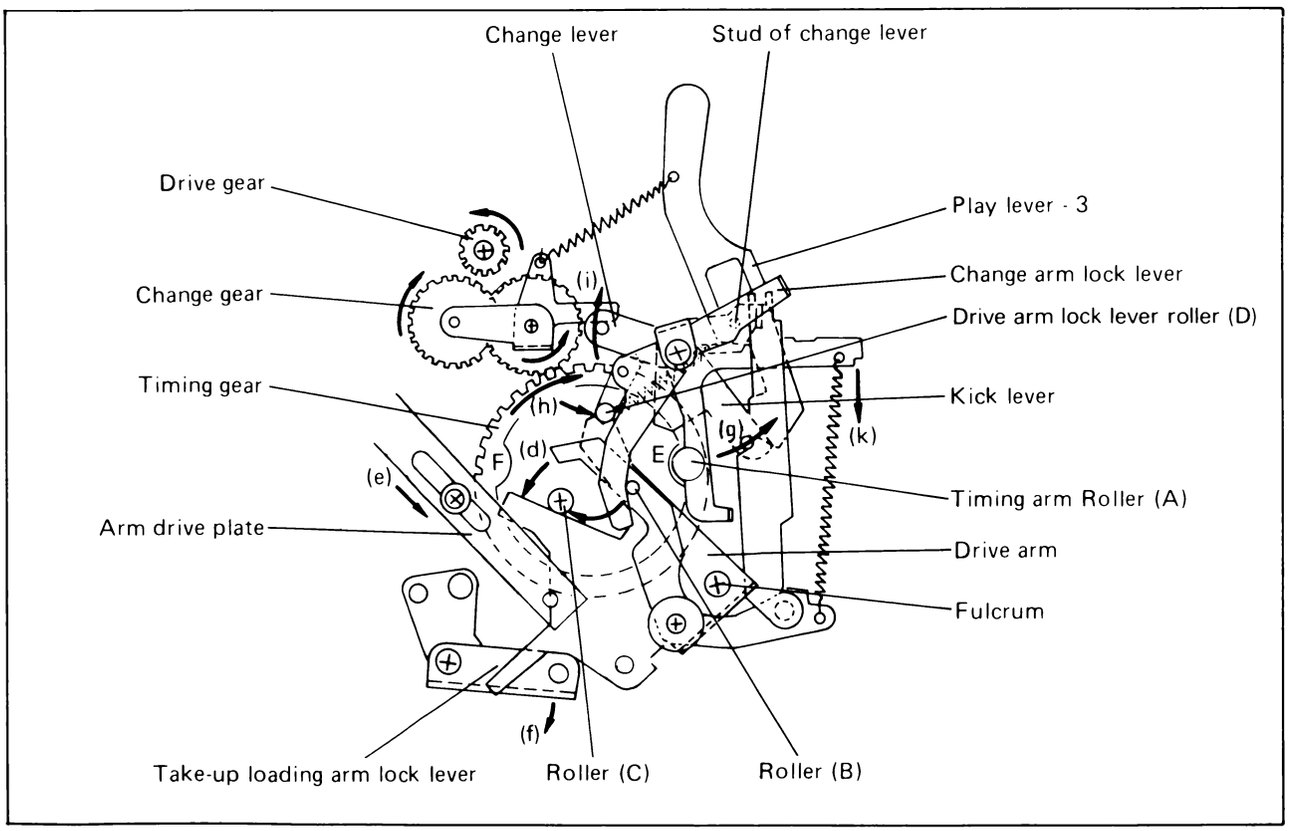



**Fig. 2-12** Play mode mechanism (bottom view)

spring is pulled to arrow (c). As a result, the pinch roller is closer to the capstan shaft. Also, the after-loading switch is turned on by the edge of the pinch roller slide plate-1. In this condition, the capstan solenoid is energized. The pinch roller slide plate-1 and -2 are more moved to arrow (c) by the plunger movement. As a result, the pinch roller is pressed against the capstan shaft. At that time, the tape traveling starts.

At the same time, by the "pulling-up" action of the memory plate with the pinch roller slide lever-1, the take-up idler lever falls into the edge of the memory plate at the point (A) and the take-up idler contacts with the take-up reel disk. At the same time, the loading brake releases from the take-up reel disk by the loading brake off lever.

In other words, the pressing action of the pinch roller and take-up idler and releasing action of the loading brake are separated at nearly the same time. However, the roller (C) of the timing arm (bottom side) has not fallen into the hollow (E) of the timing gear yet, up to this time.

When the roller (C) comes into the notch (E) of the timing gear, the change gear is stopped (bottom side). At the same time, the timing arm (bottom side) is moved to arrow (k), and the slide plate moves to arrow (f) by spring (A).

By movement of the slide plate to the left, the supply loading brake is released from the supply reel disk and the backtension cancel lever rotates clockwise (g). As a result, the supply backtension becomes effective. After that, the machine will be Play mode.

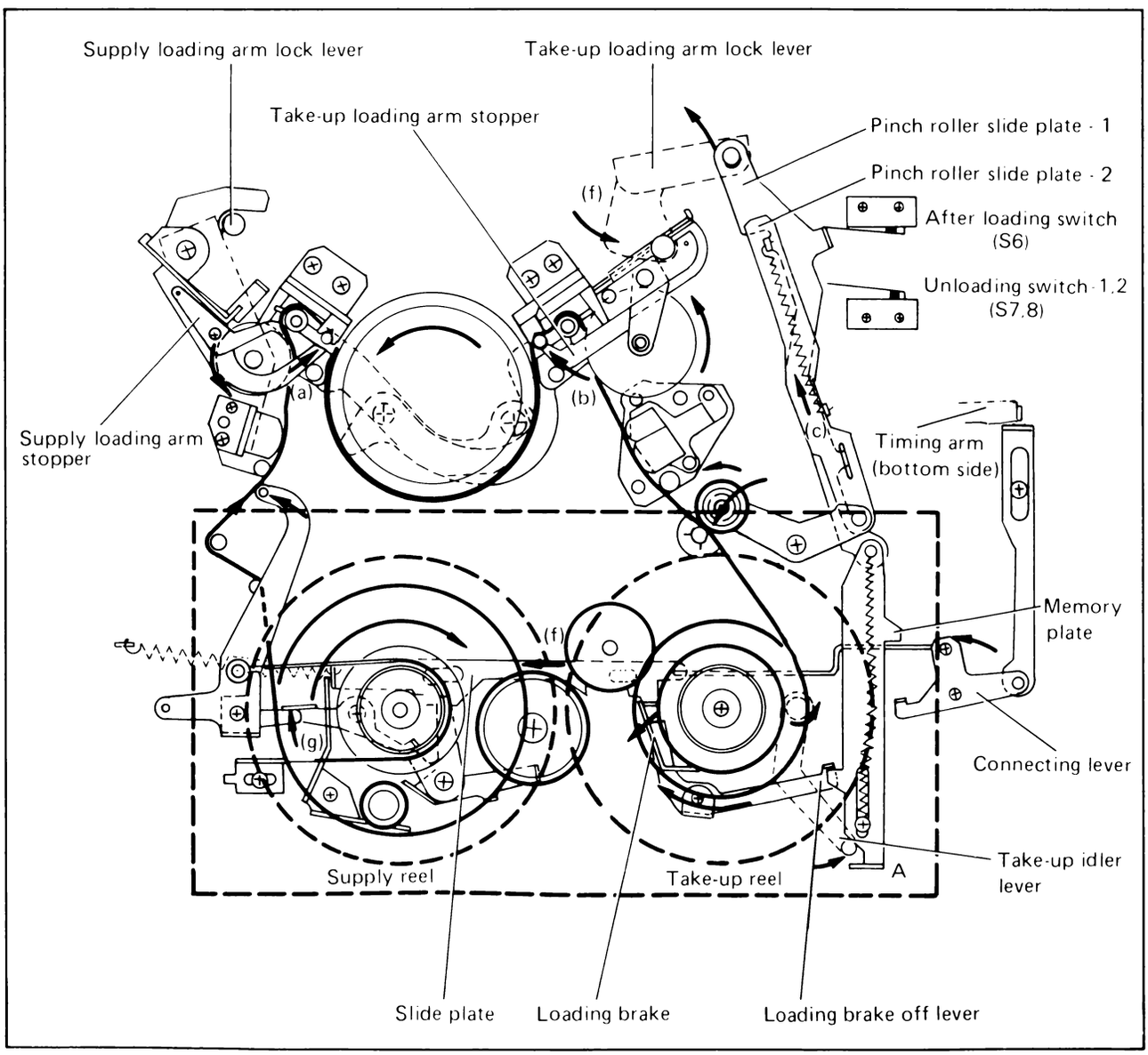



**Fig. 2-13** Play mode mechanism (Top view)

## 2.9 UNLOADING MECHANISM (Bottom view)

Refer to Fig. 2-14, Unloading mechanism (Bottom view). When the STOP key is pressed, from the Play mode, the play function mechanism is released from the lock, so that the play lever-1 and -2 which lock the change arm lock lever through the rod is moved to arrow (a) and the change arm lock lever is turned clockwise (a) by the force of spring. Also the drive arm lock lever releases from the drive arm; then the drive arm becomes free. When the change arm lock lever turned clockwise, the roller (B) fixed on the change arm becomes free so that the change arm turns counterclockwise (b) by the force of spring. At this time, the other side of the change arm moves to arrow (c), so that the change lever turned to arrow (e). As a result, the change gear is contacted with the drive gear by the rotation of the gear arm. Then, the timing gear rotates clockwise again, and the drive arm turns counterclockwise (f) to the original position.

When the roller (A) reached to the notch (E) of the timing gear, the change gear is released from the drive gear by the counterclockwise rotation of the gear arm. At this time, the rotation of the timing gear is stopped. Refer to Fig. 2-15, Unloading mechanism (Top view).

When pressing the STOP key from the Play mode, the play function mechanism is released. As a result, the unloading idler contacts with the supply reel disk, and the supply reel disk winds up the tape during unloading. At the same time, the take-up brake contacts the take-up reel disk by the movement of the off lever. On the other hand, the supply roller stopper, supply loading arm, take-up roller stopper and take-up loading arm are re-

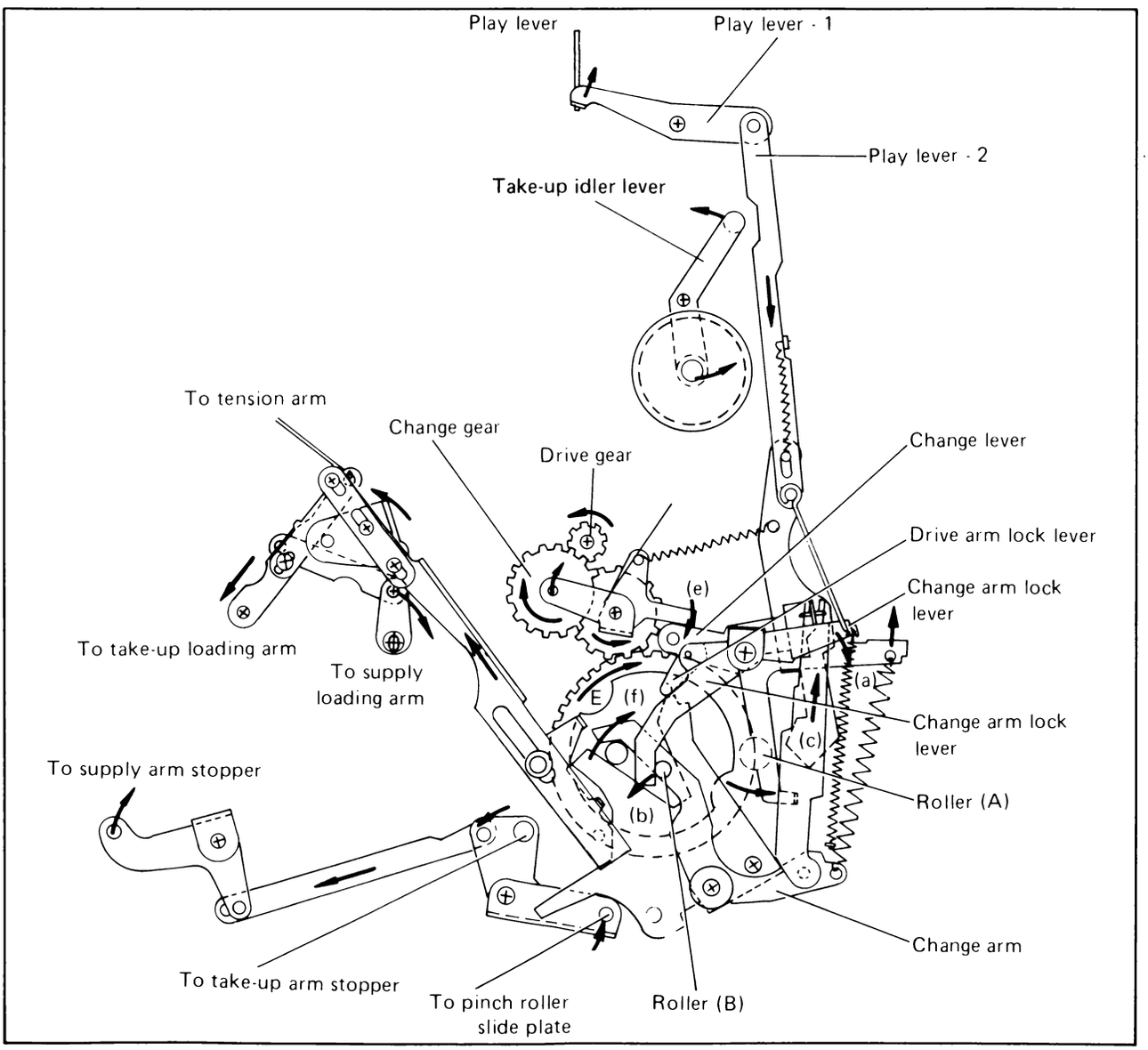



**Fig. 2-14** Unloading mechanism (Bottom view)

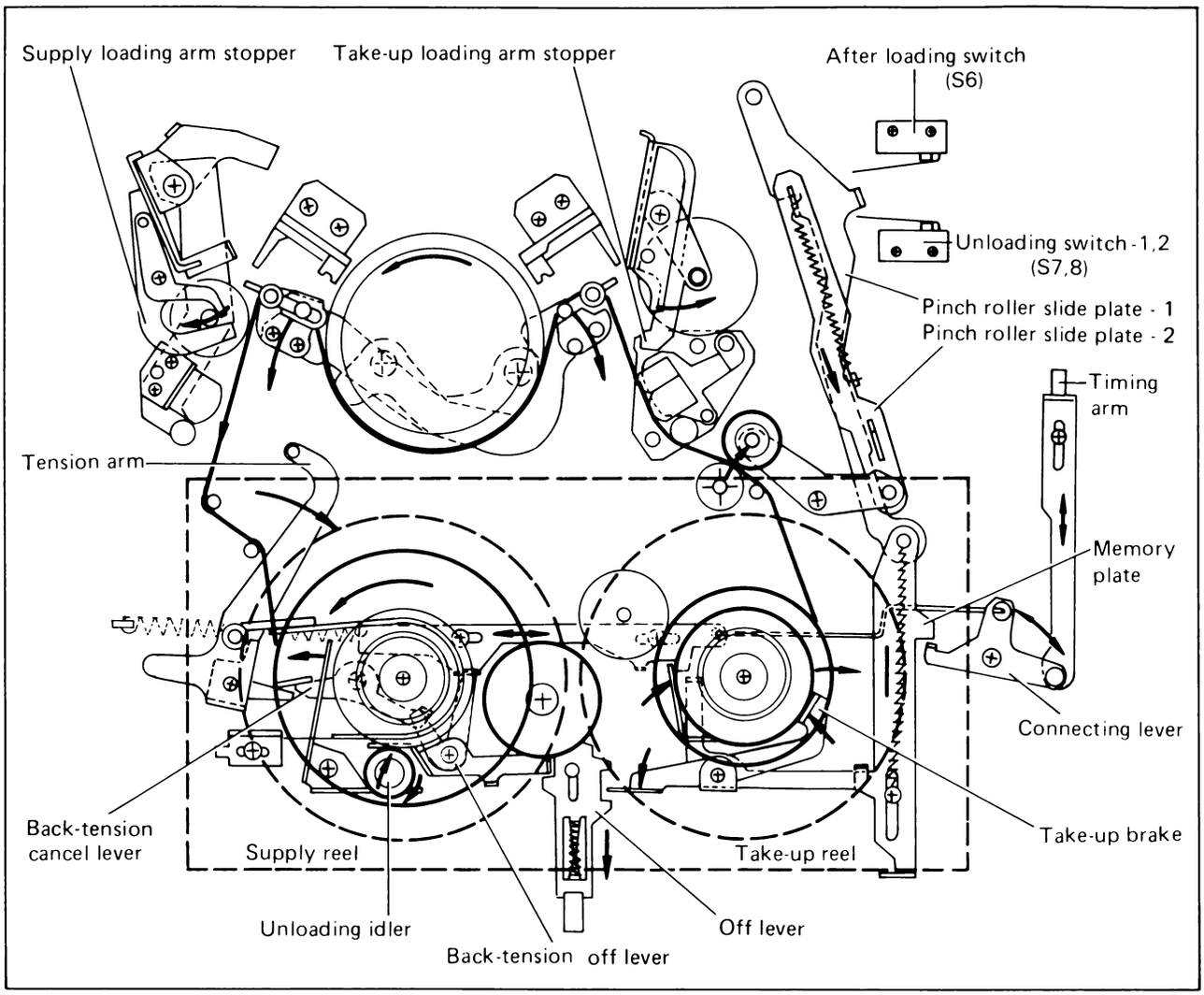



**Fig. 2-15** Unloading mechanism (Top view)

turned to original stop position, however, the roller (A) of the timing gear (bottom side) runs on the edge of the timing gear, the timing arm moves downward so that the slide plate moves clockwise. By the clockwise movement of the slide plate, the backtension cancel lever rotates counterclockwise to release the backtension from the supply reel disk. When the unloading started, the after loading switch is turned off and the after unloading is completed, the unloading switch is turned off then motor rotation is stopped.

## 2.10 F.F. MODE MECHANISM

When pressing the F.F. key, the unloading idler releases from the supply reel disk and the take-up brake releases from the take-up reel disk by the movement to arrow (a) of the off lever. Also, the pinch roller solenoid is turned on, the adjust plate is released from the take-up reel disk. Also, the supply brake arm ass'y is released from the supply reel disk. As a result, the take-up reel disk and the supply reel disk become free.

Thus, by pressing up the F.F. lever, the F.F. idler moves to arrow (b) so that the F.F. idler contacts with the rewind idler and the take-up reel disk. As a result, the tape is wound up from the supply reel disk to take-up reel disk.

## 2.11 REWIND MODE MECHANISM

When the REWIND key is pressed, the unloading idler is released from the supply reel disk and the take-up brake is released from the take-up reel disk by the movement to arrow (a) of the off lever. Also, the pinch roller solenoid is turned on, the adjust plate is released from the take-up reel disk. Also, the supply brake arm ass'y is released from the supply reel disk. As a result, the take-up reel disk and the supply reel disk become free.

On the other hand, by "pressing-up" action of the REW lever, the rewind idler contacts with the supply reel disk, so that the tape is wound up from the take-up reel disk to the supply reel disk.

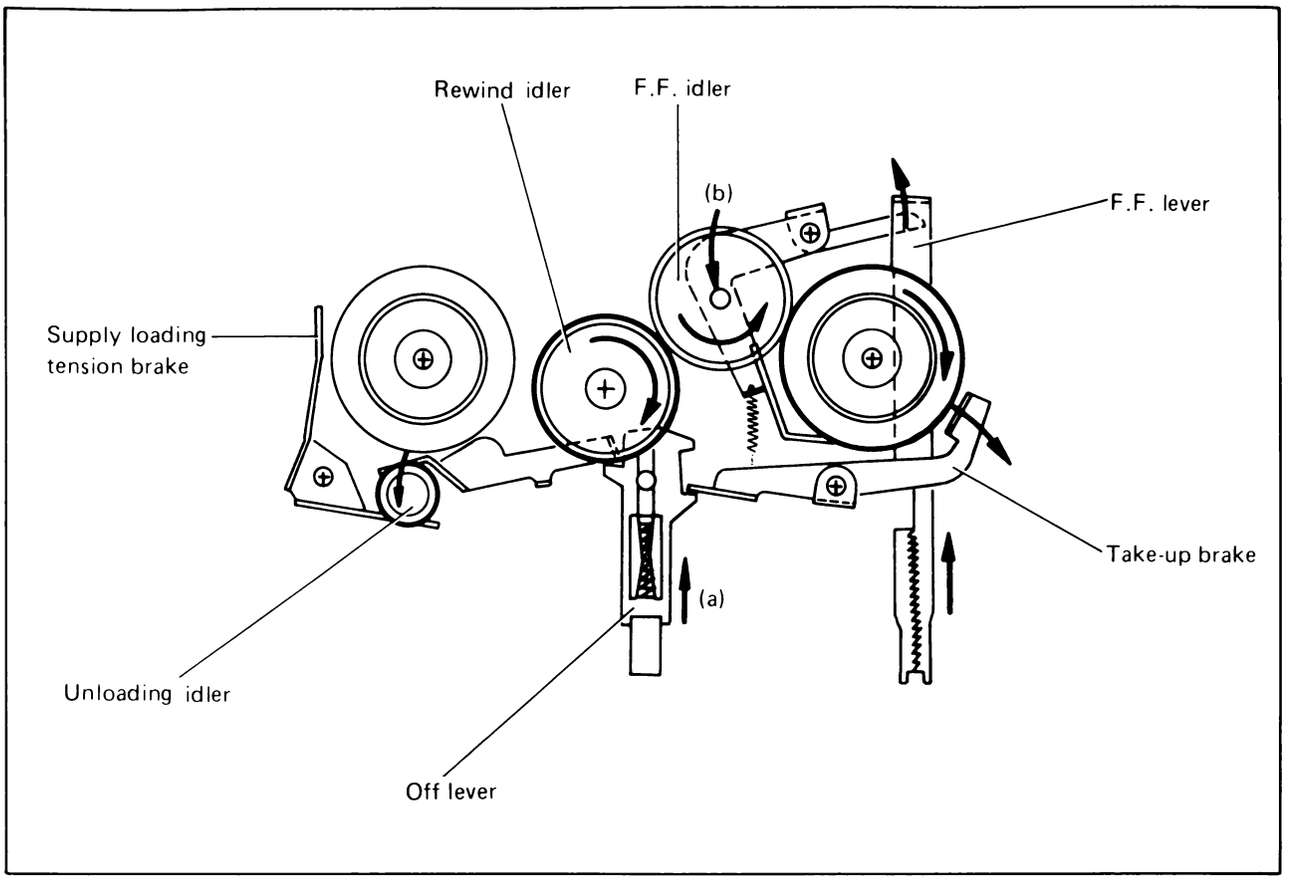



**Fig. 2-16** F.F. mode mechanism

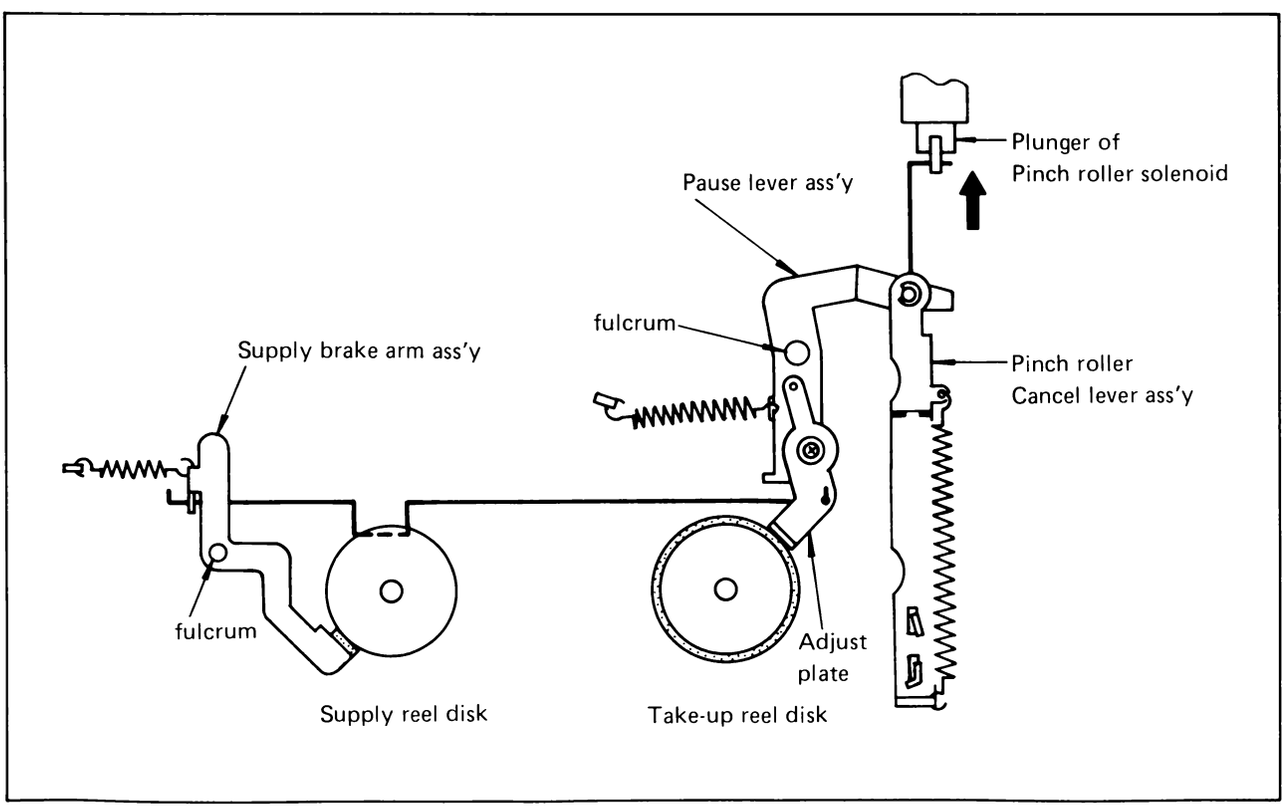



**Fig. 2-17** Pinch roller solenoid drive mechanism

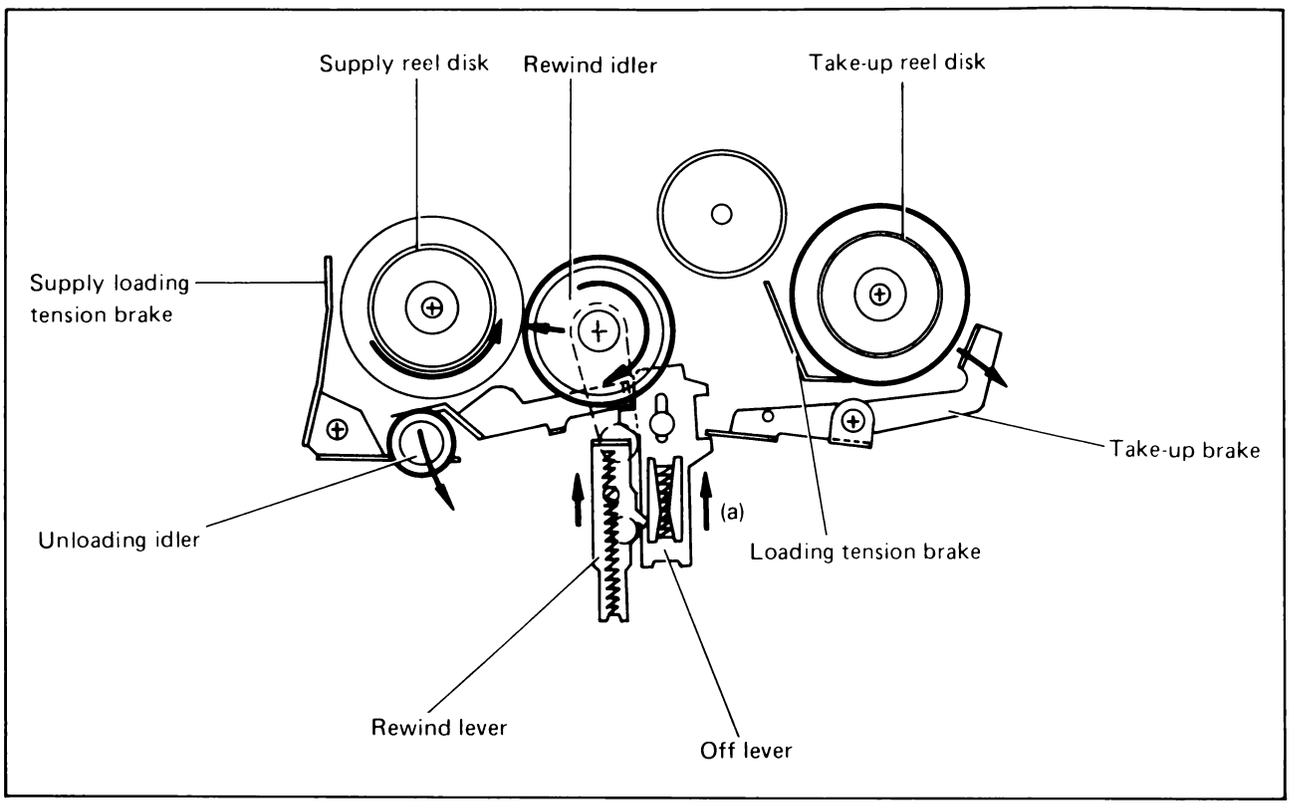



**Fig. 2-18** REW mode mechanism

## 2.12 AUTO STOP MECHANISM

When the automatic stop system operates, the stop solenoid is energized. As a result, the lever of solenoid moves into the stop ring and it is rotated in the direction of arrow (a) by the stop ring rotation. As a result, the lock plate of function ass'y is pushed in the direction of arrow (c) by the stop lever and the function keys is released. See Fig. 2-19.

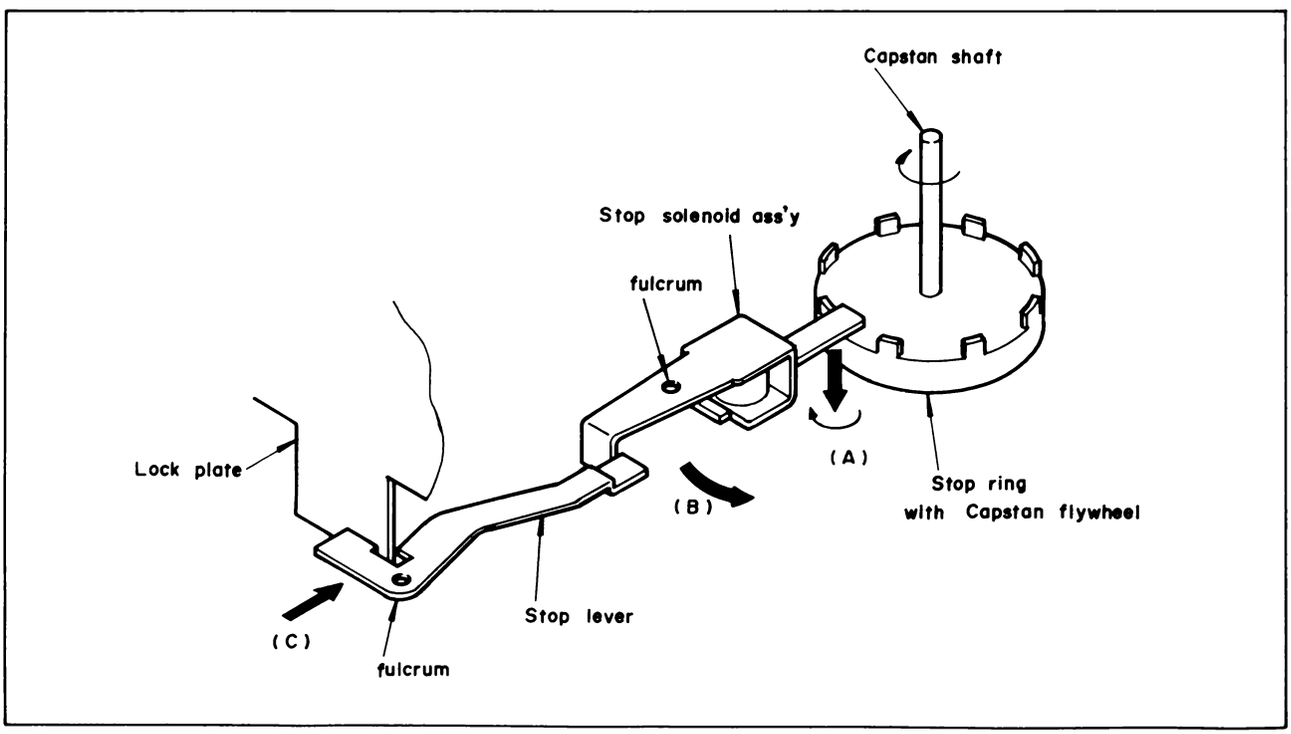



**Fig. 2-19** Auto stop mechanism

## 2.13 PAUSE MODE MECHANISM

When the PAUSE key is depressed in Record mode, the pinch roller solenoid is de-energized. The pinch roller slide plate-2 is returned to arrow (A) direction by the spring on the pinch roller cancel lever.
Then, the pinch roller is released from the capstan shaft. On the other hand, the take-up idler ass'y is released from the take-up reel disk by the take-up off lever.
Also the adjust plate is pressed against the take-up reel disk by the spring (2), supply brake arm ass'y is pressed to the supply reel disk. In this condition, tape traveling is stopped.
When the PAUSE key is depressed again, the pinch roller solenoid is energized. At that time, the unit return to Record mode.

**Note:** The HR-4100E memorizes the function mode when the DC power source is cut-off. Therefore, when the DC power source is cut-off during recording, and afterward turned on, Record mode is still effective. The recording will start again without the unloading-loading cycle.

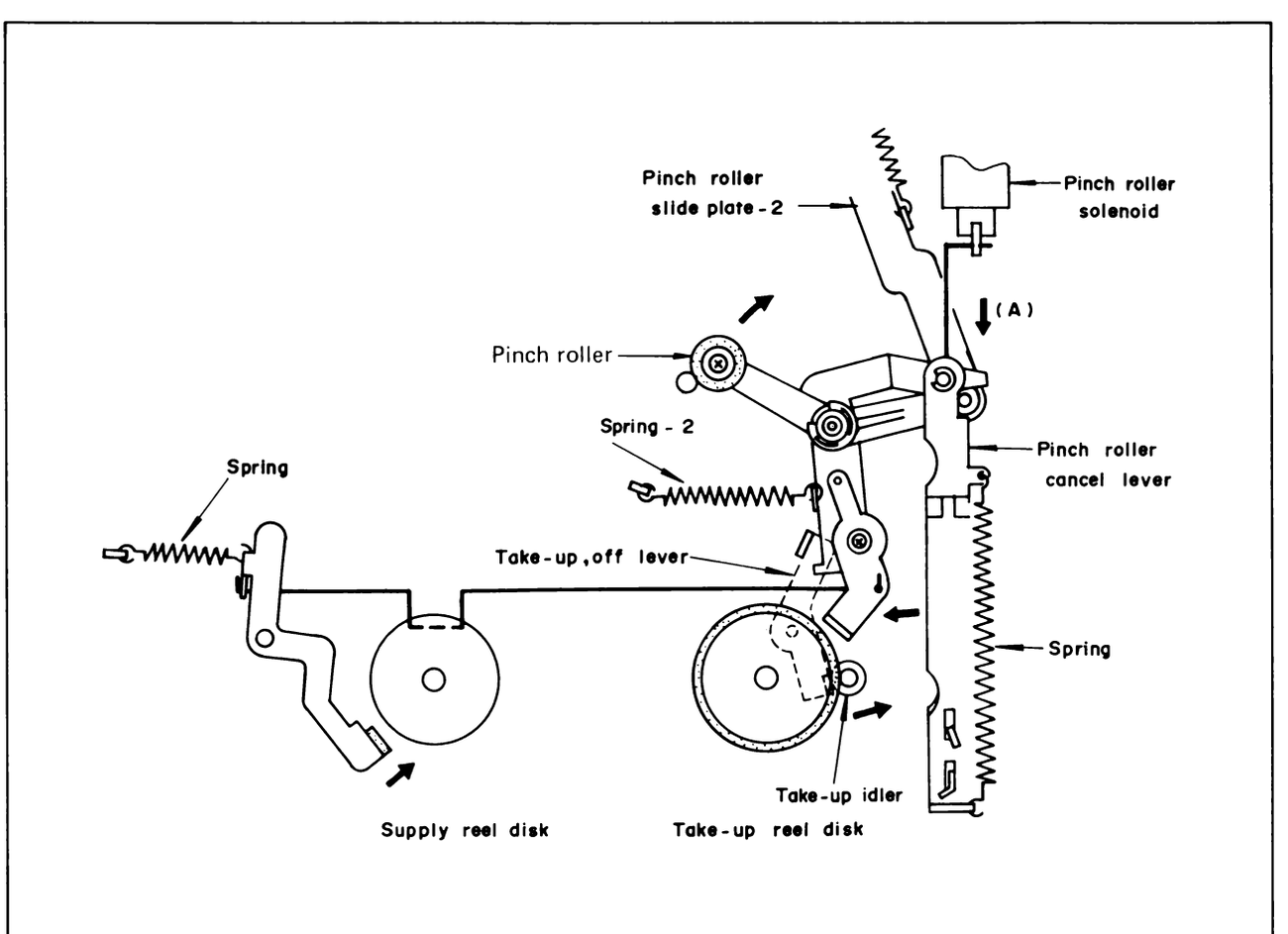



**Fig. 2-20** Pause mode mechanism

# SECTION 3
# CIRCUIT DESCRIPTION

## 3.1 GENERAL

The electronic circuit in this model is divided into seven major circuit boards; Preamplifier and Record amplifier, Luminance (Y) and Color amplifier, Audio and Drum Servo, Regulator and Capstan Servo, Mechanism control, Operation and Connector circuit boards.

Since the electronic circuitry must be assembled within a limited space, a number of IC's are employed, and the circuit design used in common for the recording and the playback circuit makes the best use of the limited space.

## 3.2 VIDEO SYSTEM

### 3.2.1 General

In this video cassette recorder, video signals are recorded on a magnetic tape by two rotary video heads. For playback, video signals are re-generated from the magnetic tape through the same video heads. However, it is a general characteristic of magnetic heads that the current generated in playback is proportional to the flux field. Fig. 3-1 illustrates this principle.

The roll-off at higher frequencies is caused by a combination of factors: gap loss (wavelength approaching gap length), tape losses, etc.

For a number of reasons, including the overall bandwidth of the signal, tape limitations and playback characteristics, recording a video signal directly is not feasible. Therefore, the HR-4100E converts the input video signal to an FM signal before recording. It is necessary, of course, to demodulate the FM in playback. In a unit of this size, it is difficult to maintain the time-base stability necessary to permit direct recording of the chroma signal. The effects of this instability are minimized by processing the luminance and chrominance separately. Refer to Fig. 3-2.

The luminance signal is frequency modulated between the limits: 3.8 MHz for sync tip and 4.8 MHz for peak white. The chroma signal is separated from the luminance by a band-pass filter. The subcarrier is then converted from 4.43 MHz to 626.9 kHz, linearly mixed with the FM luminance signal and directly recorded as a sideband of 626.9 kHz. The FM signal also functions as an AC bias for 626.9 kHz colour signal. In playback, those signals are separated by filter networks and processed individually. The FM luminance signal is demodulated, while chroma subcarrier is converted back to 4.43 MHz. Automatic colour correction circuitry minimizes hue and chroma amplitude variations before the signals are recombined. The output signal is PAL-type. An explanation of the block diagram and details of the circuit are as follows. Refer to the overall block diagram and the appropriate schematic diagram in Section 10.

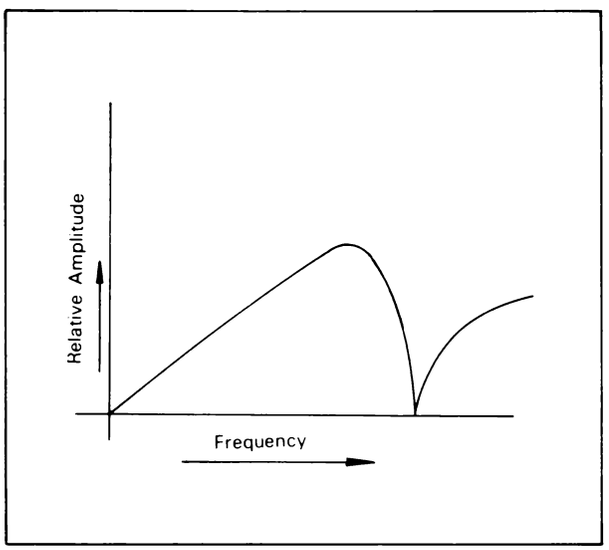



**Fig. 3-1** Characteristic response curve for playback head

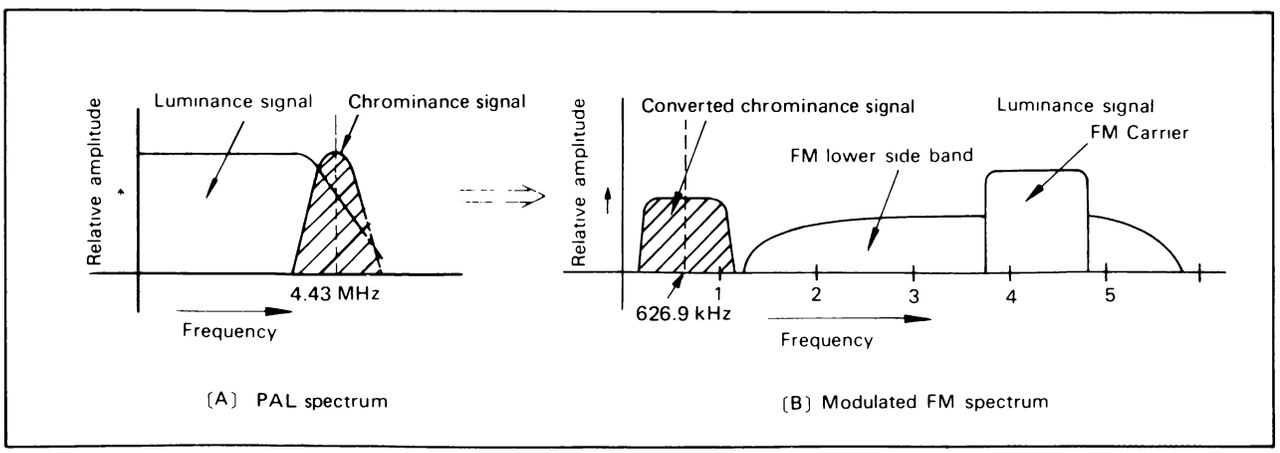



**Fig. 3-2**

### 3.2.2 Luminance signal recording system

Refer to Fig. 3-3, Block diagram of the luminace signal recording system. The input video signal is kept at a constant level by utilizing an AGC (Automatic Gain Control) circuit, in IC1, so that a constant level may be maintained in spite of fluctuation of input level. This video signal is fed to pin 9 of IC2, AMPLIFIER and SWITCHER. This switcher selects the video signal either record mode or playback mode by PB 9 V DC power supply or REC 9 V DC power supply.

Then video signal is fed to the LPF-1 and LPF-2.

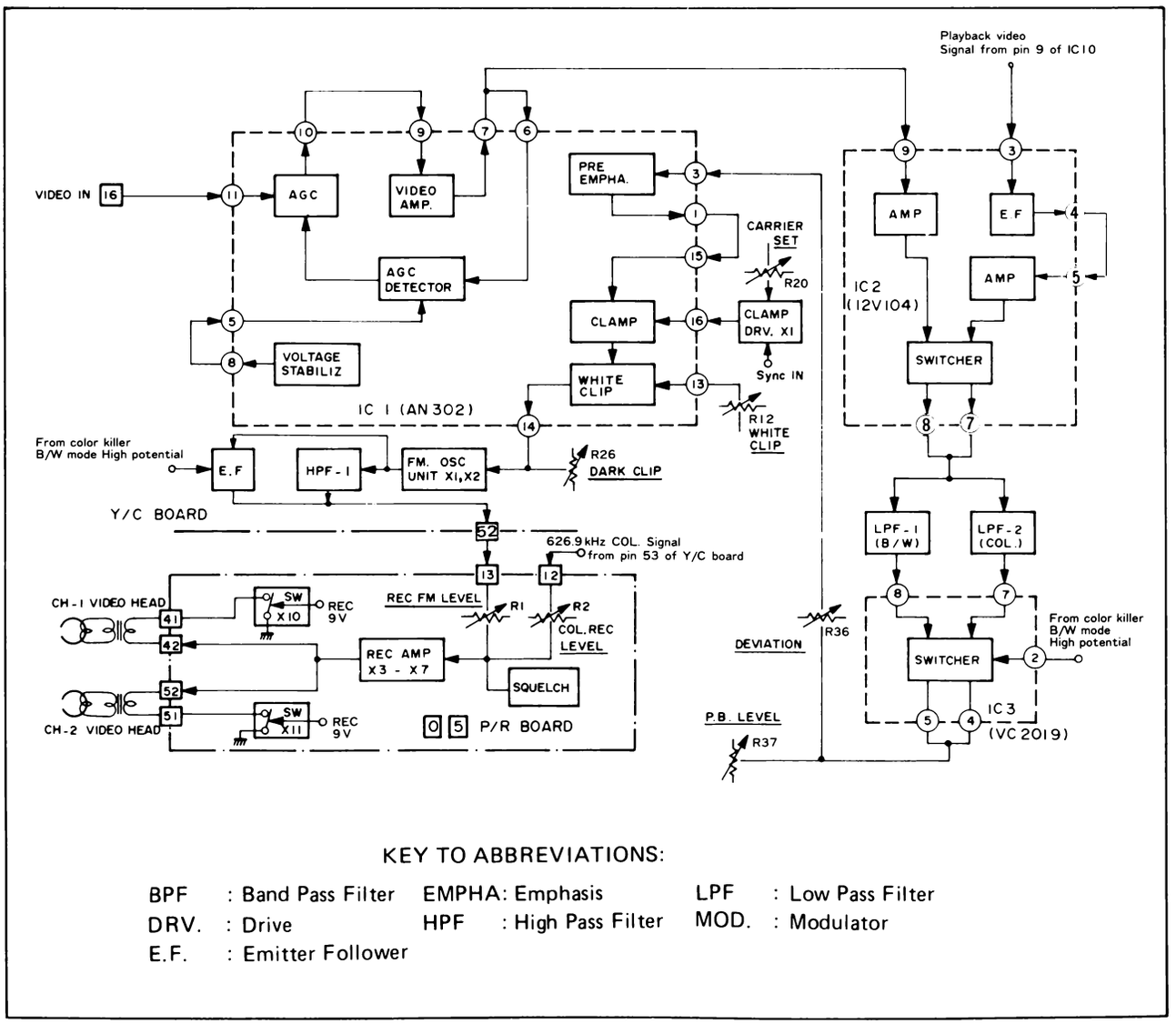
Integrated Circuit IC3 (VC2019) is an electronic switch. It performs change-over of the video signal between colour and black-and-white controled by the DC power supply (B/W mode High potential) to pin 2 of IC3.

In the case of the colour mode, pin 4 and pin 7 of IC3 becomes conductive, so that the signal fed through the LPF-2 (Low Pass Filter-2) which rolls off at 3.38 MHz will pass through the IC3.

However, in the case of the Black-and-white mode, pin 8 and pin 5 of IC3 becomes conductive by B/W mode DC power supply. So the signal passing through the LPF-1 which rolls-off at 4.1 MHz will pass through SWITCHER of IC3.

After passing through the R36 (DEVIATION), this luminance signal is supplied to pin 3 of IC1 (AN302) PRE-EMPHASIS to improve the signal to noise (S/N) ratio of the video signal. (Pre-emphasis of high frequencies, and later de-emphasis in demodulation, improves the S/N ratio since much noises exist in the high frequencies.)

The pre-emphasized signal is clamped at the sync tip by a clamping circuit, at a level determined by R20 (CARRIER SET) for a 3.8 MHz and peak white level determined by R36 (DEVIATION ADJ) for 4.8 MHz. This is done to prevent drift of the FM carrier caused by variations in the mean DC level of the video signal. The high frequency boost resulted by pre-emphasis causes overshoot in areas of rapid change of signal level.




KEY TO ABBREVIATIONS:

| | | | | | |
|---|---|---|---|---|---|
| BPF | : Band Pass Filter | EMPHA: | Emphasis | LPF | : Low Pass Filter |
| DRV. | : Drive | HPF | : High Pass Filter | MOD. | : Modulator |
| E.F. | : Emitter Follower | | | | |

**Fig. 3-3** Block diagram of luminance signal recording system

To prevent overdeviation of the modulator, dark and white clip circuits are used. The output signal of the white clip circuit is fed to the FM modulator, a kind of astable multivibrator.
The modulator was designed to operate at 3.8 MHz at the sync tip and 4.8 MHz at peak-white level.
This modulated FM signal is fed through the high-pass filter (H.P.F.) where all frequencies below approximately 1.4 MHz are eliminated from the spectrum.
After passing through the emitter follower X8, the modulated signal is supplied to the Pre/Record amplifier printed circuit board. Then, at the mixer, this signal is mixed with the converted chroma signal from the colour amplifier. The mixed signal is amplified by the record amplifier and coupled through the rotary transformer to the video head.

1. AGC (Automatic Gain Control), AGC DETECTOR – (IC1, AN302)

The signal from the video input passes through AGC and the Video Amplifier and reaches pin 7 of IC1, which is the AGC output. The signal of AGC output transmitted to the RLC-1, to eliminate the 4.43 MHz colour components, and then supplied to the pin 6 of IC1 which is connected with AGC DET (detector).
The AGC DET (detector) rectifies the video signal from the VIDEO AMP. This DC current is used for a DC bias current of detector.
The AGC is differential type and AGC DET (detector) supplies reference DC current.

2. SWITCHER (IC2), LPF-1, LPF-2, SWITCHER (IC3)

Integrated Circuit IC2 (12V104) is an AMPLIFIER and SWITCHER. It performs change-over of the output video signal of IC2, by PB 9 V DC power supply or REC 9 V DC power supply.
Refer to Fig. 3-4.
In the case of the record mode, the REC 9 V DC power is supplied to pin 11 of IC2, so that the video signal from AGC out (pin 7 of IC1) appears at pin 8 of IC2.
In the case of the playback mode, playback video signal

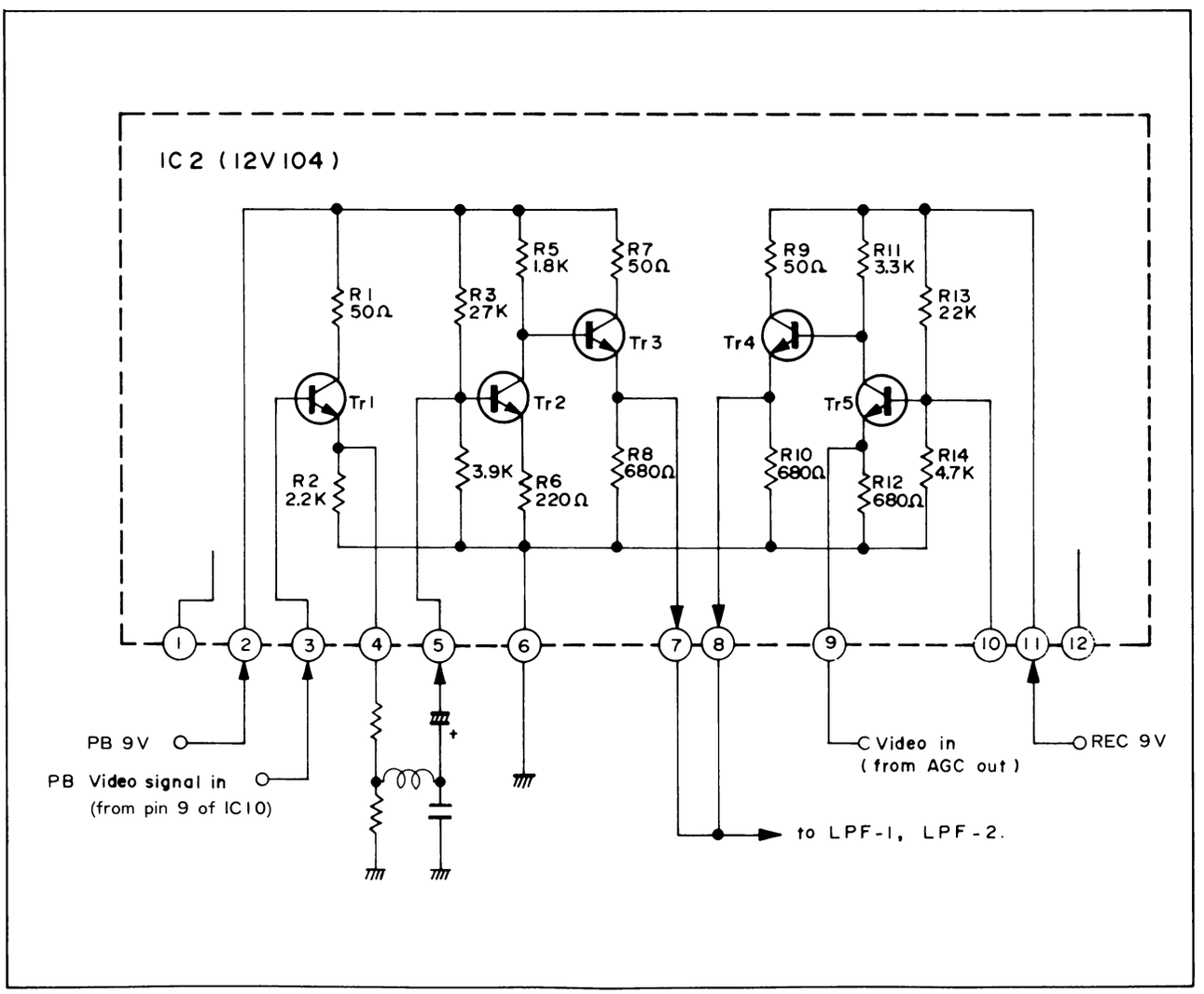



Fig. 3-4

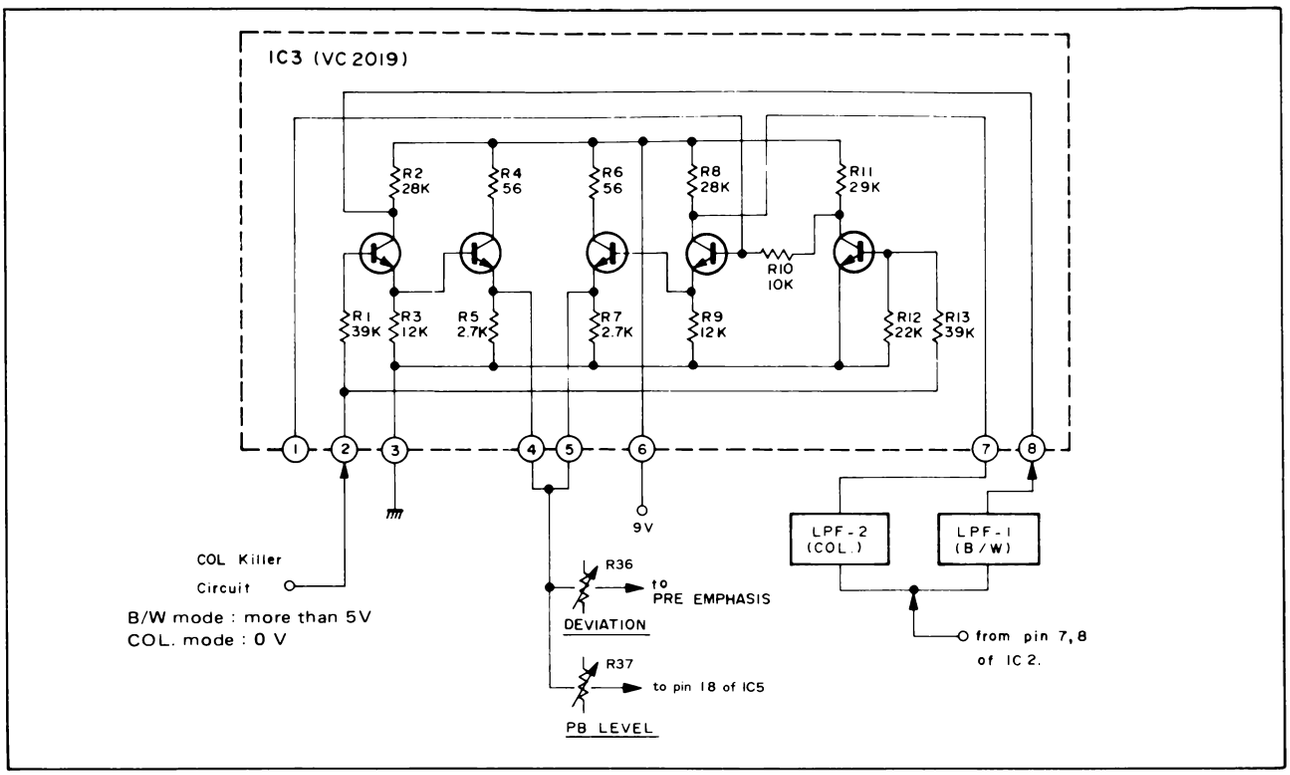



Fig. 3-5

from pin 9 of IC10 is fed to pin 3 of IC2 and PB 9 V power is supplied to pin 2 of IC2, so that the video signal appears at pin 7 of IC2.

Refer to Fig. 3-5, SWITCHER.

After passing through the SWITCHER (IC2), the video signal is supplied to LPF1, LPF-2 and SWITCHER (IC3).

Characteristics of LPF-1, LPF-2 are shown in Fig. 3-6.

Intergrated Circuit IC3 (VC2019)i is an electronic switch. It performs change-over of the video signal between colour and black-and-white, controlled by colour killer circuit. In the case of the colour mode, pin 2 of IC3 is grounded potential so that the video signal coming from pin 7 or 8 of IC2 is first supplied to LPF-2 (Low-Pass-Filter-2) which rolls off at 3.3 MHz will pass through the SWITCHER of IC3.

Also, LPF-2 has 0.9 $\mu$s delaying function for adjusting the timing of colour signal and luminance signal. Then, this video signal is supplied to R36 (DEVIATION) at the record mode and R37 (PB LEVEL) at the playback mode. In the case of the black-and-white mode, pin 2 of IC3 is charged with the Black-and-White mode 9 V DC power supply, so that the video signal from pin 7 or 8 of IC2 fed through LPF-1 which rolls off at 4.1 MHz will pass through the SWITCHER of IC3.

Then, this video signal is supplied to R36 (DEVIATION) at the record mode and R37 (PB LEVEL) at the playback mode.

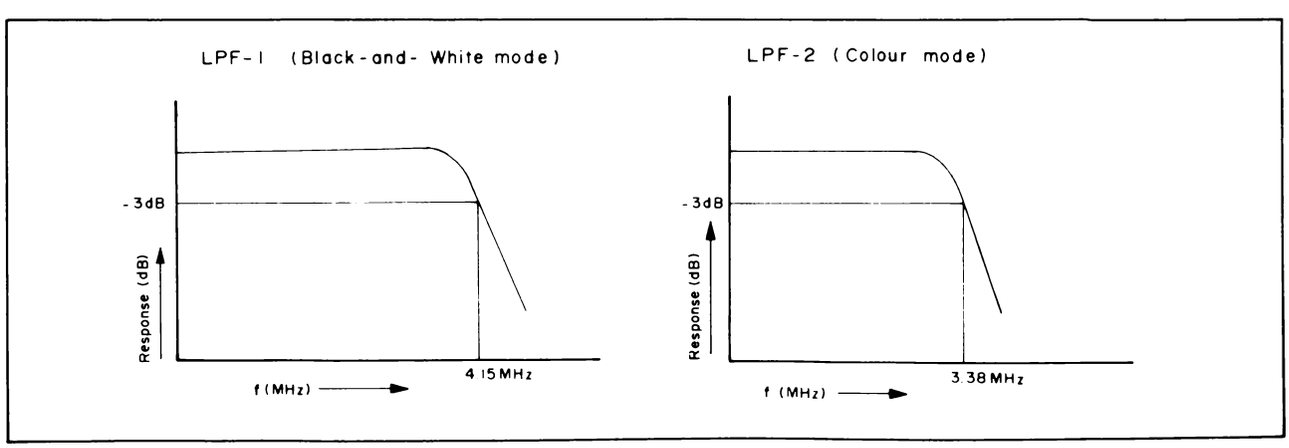



Fig. 3-6 Characteristic of LPF-1 and LPF-2

3. PRE-EMPHASIS – IC1, AN302

The video signal which has just passed through LPF-1 or LPF-2 is adjusted in level at the deviation adjuster, (R36) then is supplied to the Pre-emphasis circuit which improves the signal-to-noise (S/N) ratio of the video signal. In general, FM modulated signals are influenced in amplitude and phase by noise. And also, the higher the frequency is, the more it is affected and has S/N deterioration upon demodulation.

Pre-emphasis of this model functions more strongly than that of conventional 3/4"-VCRs. For, this model requires much more consideration on S/N ratio than for conventional ones because of its unique high density recording system.

Pre-emphasis is decided by the frequency charateristic of the feedback loop from pin 1 of IC1 to pin 2 of IC1.

4. CLAMP, WHITE CLIP and DARK CLIP

The pre-emphasized video signal is supplied to pin 15 of IC1, CLAMP, which makes the sync tip hold constant potential accurately so that sync tip may be at 3.8 MHz upon FM modulation.

The pre-emphasis or high frequency boost causes over-shoot or undershoot, it is difficult to clamp the signal at sync tip. Therefore, exact sync tip clamping is made by switching circuit X3 (Clamp Drive).

To prevent over-deviation of the modulator, dark and white clip circuit are used. Dark clip is set by R26 (DARK CLIP) and the setting of R12 (WHITE CLIP) determines white clip level.

The signal treated as above is supplied to FM modulator.

Reference: In the case of overmodulation there frequently occurs AM phenomenon in the modulated wave, which causes reverse of black and white and deterioration of S/N ratio.

4. FM MODULATOR

The video signal from the White and Dark Clippers is supplied to FM MODULATOR. The FM modulator is a kind of unstable multivibrator with input voltage determined by the video signal.

The oscillation frequency of the FM modulator is shown by the following formula:

$$f = \frac{1}{2CR \log_e (1 + \frac{E_O}{E_{in}})}$$

f is frequency in cycles per second (Hertz).

$E_{in}$ is input signal voltage.

RC is the time constant of base charging circuit.

$E_O$ is power supply voltage.

The modulator was designed to operate at 3.8 MHz at the sync tip and 4.8 MHz at the white peak as shown in Fig. 3-7.

The FM modulator is unified and there are feed-through type capacitors (signal part: 22 pF, power source part: 1000 pF) at the input and output terminals. Which prevent the signal from breaking out of the FM modulator.

D3 and D4 are temperature compensating diodes.

Then the FM-modulated signal is supplied to HPF (High Pass Filter).

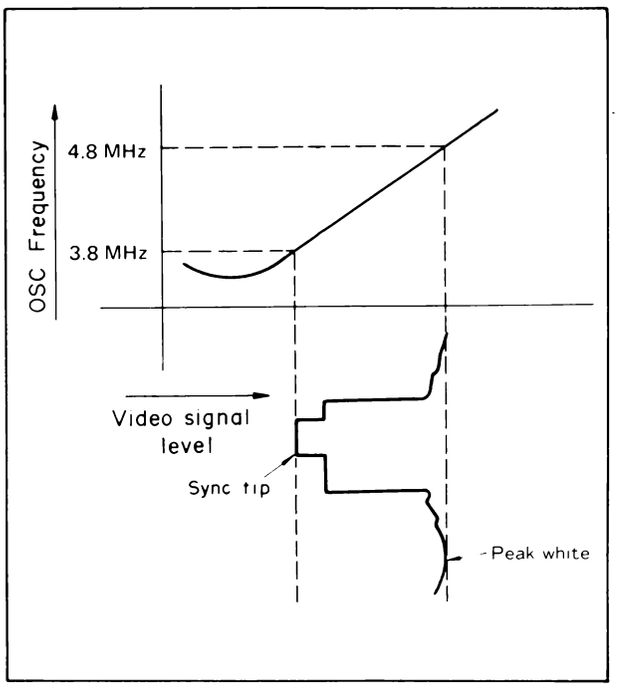



**Fig. 3-7** Video to FM transfer characteristics

6. HPF-1 (High Pass Filter)

HPF (High Pass Filter) functions in attenuating the part which lower side bands of FM frequencies generated by FM modulation fall on lower band of converted colour signal. The modulator output is coupled across a high pass filter which eliminates the part (all signals in the spectrum below approximately 1.4 MHz) which are lower than sidebands of FM modulation.

The FM signal that passed through HPF is supplied to ;X8 (Emitter Follower) which makes the signal low impedance and sends it to the Preamplifier/Record amplifier circuit board.

7. REC AMP (Recording Amplifier), SQUELCH

The FM modulated signal is supplied to Preamplifier and Recording amplifier circuit from X8, X9 of Luminance and colour amplifier circuit, then mixed with the converted chroma signal (626.9 kHz) at the Preamplifier and Record amplifier circuit. Transistors X1 and X2 in the Record amplifier constitute a squelch circuit controlled by After Loading (AL)12 V power supply.

The FM modulated signal is not supplied to recording amplifier for about 3 s after loading is completed, by the squelch circuit. This avoids mis-erasing of recorded signal, which is apt to happen when a tape travelling is not completed.

### 3.2.3 Couour signal recording system

Refer to Fig. 3-8.

The chroma signal is separated from the video signal by the band-pass-filter (BPF-201). This chroma signal is amplified by IC201, supplied to emitter follower (EF) which provides a low impedance drive, then supplies to ACC (Automatic Color Control) circuit. The output ACC (Automatic Color Control) is kept at a constant level, then supplied to the balanced modulator. At the balanced modulator the subcarrier is converted by mixing the colour signal of 4.43 MHz and 5.06 MHz.

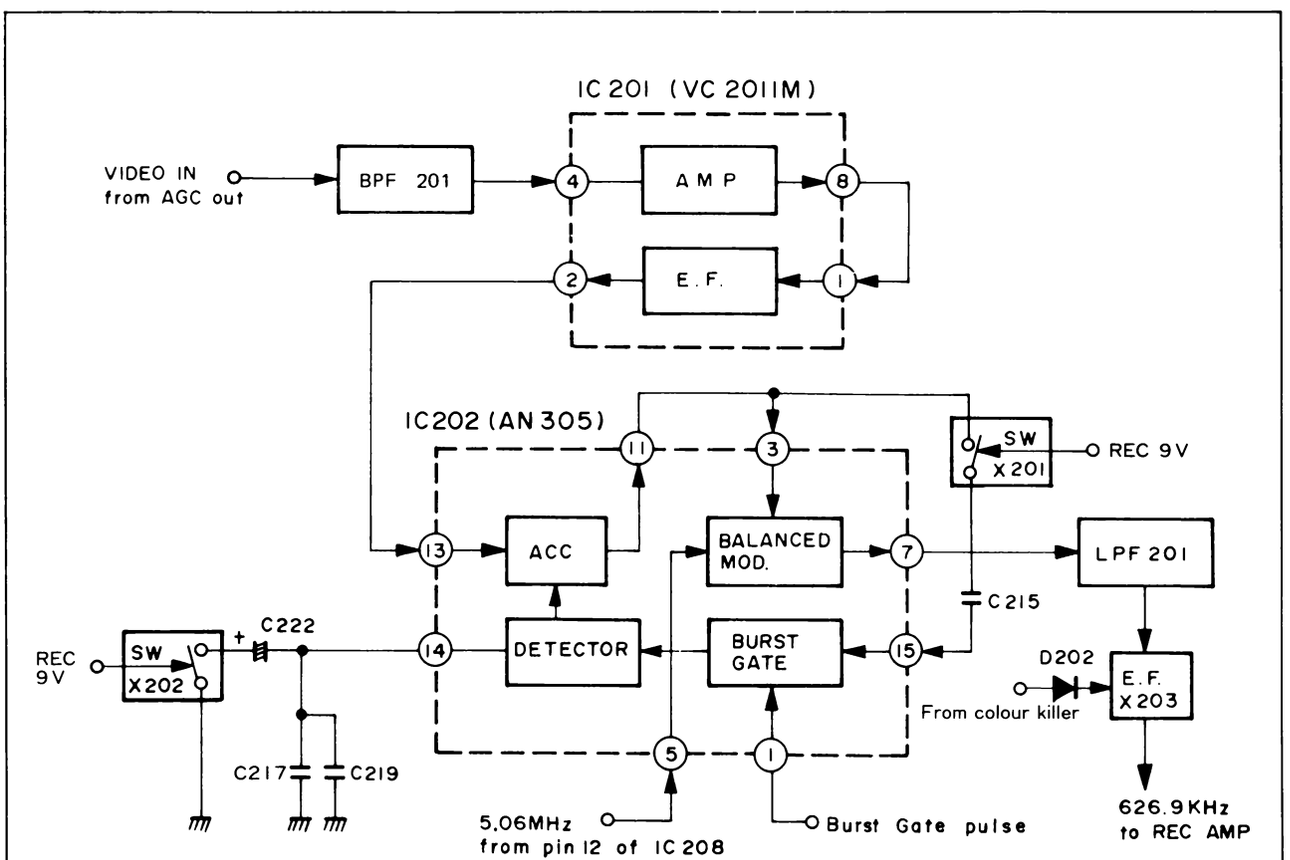
The output of the balanced modulator is the sum and difference frequencies of both input signals. They are fed to the LPF and only the difference frequency (626.9 kHz) is pressed. Then the chroma signal is mixed with the luminance signal at the recording amplifier, and fed to the video head.

1. BPF-201 (Band-pass-filter), AMPLIFIER, EF (Emitter Follower)

The video signal from pin 7 of IC1 (AGC output) is supplied to band-pass-filter (BPF-201). See Fig. 3-9. The band-pass-filter eliminates any residual luminance component in the signal and allows only the 4.43 MHz subcarrier and 500 kHz modulation to be passed to pin 4 of IC201 (amplifier).

Refer to Fig. 3-8.

The output of the amplifier, pin 8 of IC7, is connected. After passing through the emitter follower, the chroma signal is supplied to pin 13 of IC202, ACC (Automatic Color Control) circuit.




KEY TO ABBREVIATIONS:

| | | |
|---|---|---|
| ACC | : | Automatic Colour Control |
| BPF | : | Band Pass Filter |
| E.F. | : | Emitter Follower |
| LPF | : | Low Pass Filter |
| SW | : | Electronic Switch |

**Fig. 3-8** Block diagram of colour signal recording system

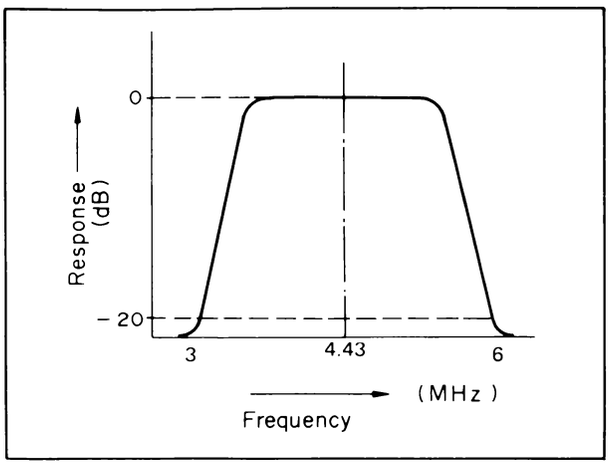



**Fig. 3-9** Characteristic of BPF-201

2. ACC, ACC DETECTOR-IC202 (AN305)
Refer to Fig. 3-8.
This ACC is peak-type and maintains the level of the 4.43 MHz colour signal constant in record mode and the playback mode. In the record mode colour signal from pin 11 of IC202 (ACC output) is supplied to pin 15 of IC202 BURST GATE through C215 because X201 (SW) is tured on by the REC 9 V DC power supply. At the same time, the burst gate signal is supplied to the pin 1 of IC202, so that the burst signal is separated at the BURST GATE and then, this signal is supplied to the ACC detector (DETECTOR).
At the ACC detector (DETECTOR), the peak level of the burst signal is picked out and rectified to DC voltage change as a control voltage. That is a burst level change is detected as a DC component change so that the ACC output is automatically controlled at the constant level.
In recording mode, transistor X202 turns on, so that the pin 14 of IC202 connected with C217, C219 and C222 That is a time constant of ACC detector.
In playback mode, the chroma signal from pin 1 of IC203 is supplied to pin 15 of IC202, and the burst pulse is supplied to pin 1 of IC202. The burst signal is picked out at the GATE, and sent to the detector (DET.).
At the detector, the burst level change from the burst gate is detected as a DC component change, and sent to the ACC as a control voltage. Also, transistor X202 is turned off so that the time constant of detector is determined by C219 and C217.

3. BALANCED MODULATOR (IC202) – LPF-201, E.F.
Integrated circuit IC202 is a frequency converter; the 4.43 MHz subcarrier is fed to pin 3 of IC202 from ACC circuit and the 5.06 MHz CW is fed to pin 5 of IC202. As a result, both sum and difference frequencies will be seen in pin 7 of IC202 as shown in Fig. 3-10.

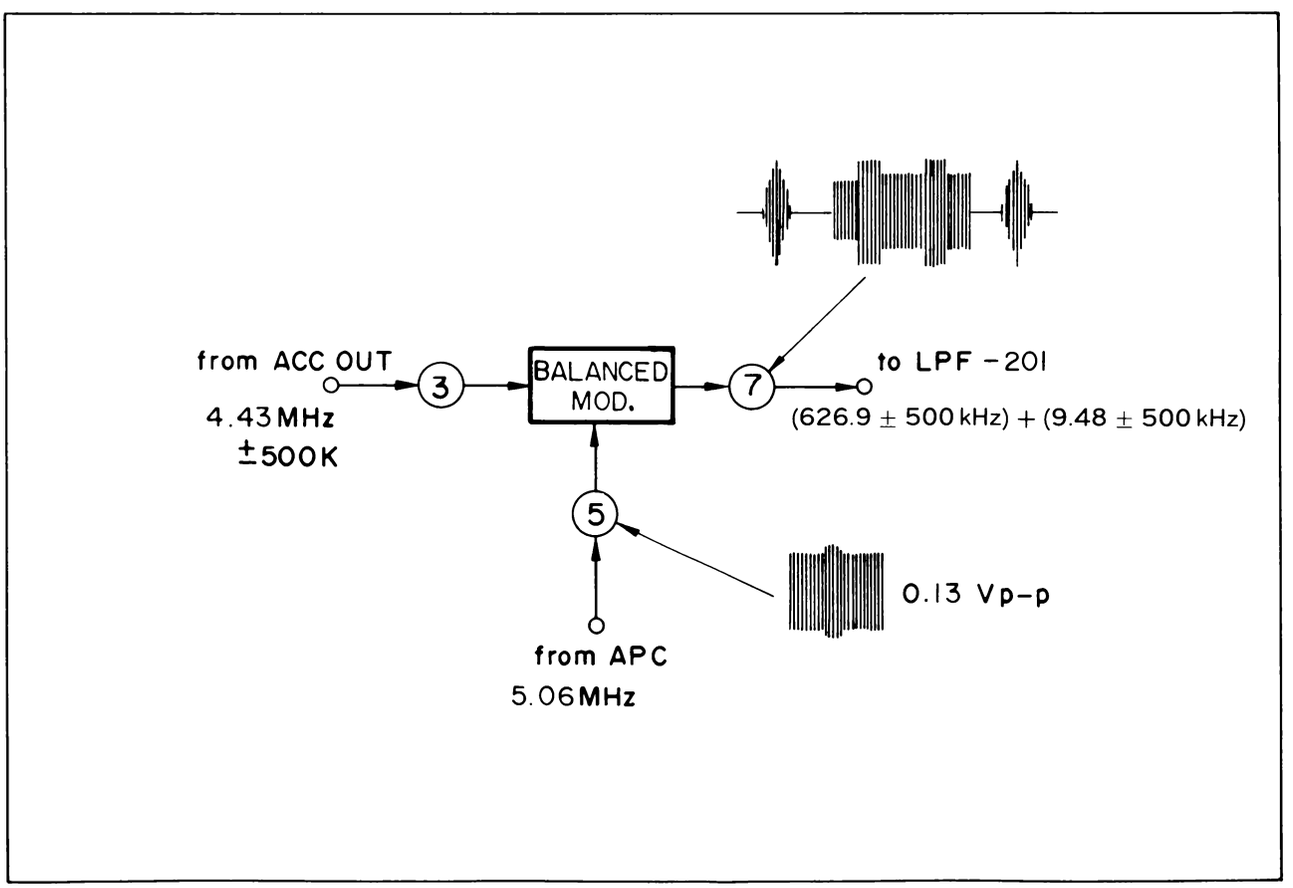



**Fig. 3-10** Main converter

Sum frequencies component ... 9.49 MHz ± 500 kHz
Difference frequencies component ..... 626.9 kHz ± 500 kHz

Both signals 9.49 MHz and 626.9 kHz, are presented at the input of LPF-201 (Low-Pass Filter) which rolls off at approximately 1.5 MHz. This means that only the 626.9 kHz is obtained at the output of LPF-201.

In the HR-4100E the phase-shift-colour recording system has been adopted, which rotates phase of the colour signal $-90^{\circ}$ every 1-H for CH-2 video head at the recording, so that the 5.06 MHz signal from APC is as follows:

5.06 MHz ± F (F : phase rotation)

Therefore the converted frequency is:

(5.06 MHz ± F) – (4.43 MHz ± 500 kHz)
= 626.9 kHz ± F ∓ 500 kHz.

According to the above, it will be clear that the phase of low frequency converted chroma signal is rotated $-90^{\circ}$ for CH-2.

The output signal of LPF-201 is sent to the emitter follower (X203), then sent to the pre-amplifier and record amplifier board.

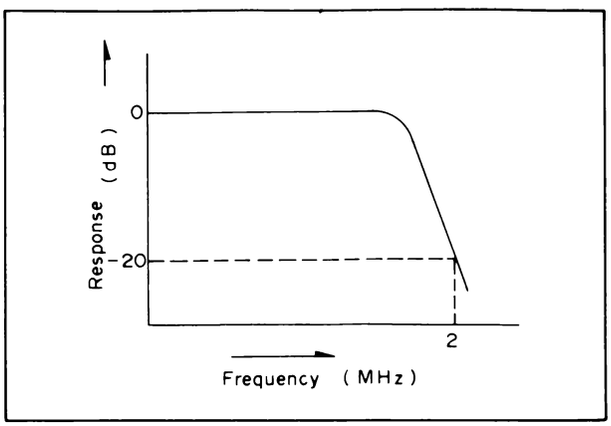
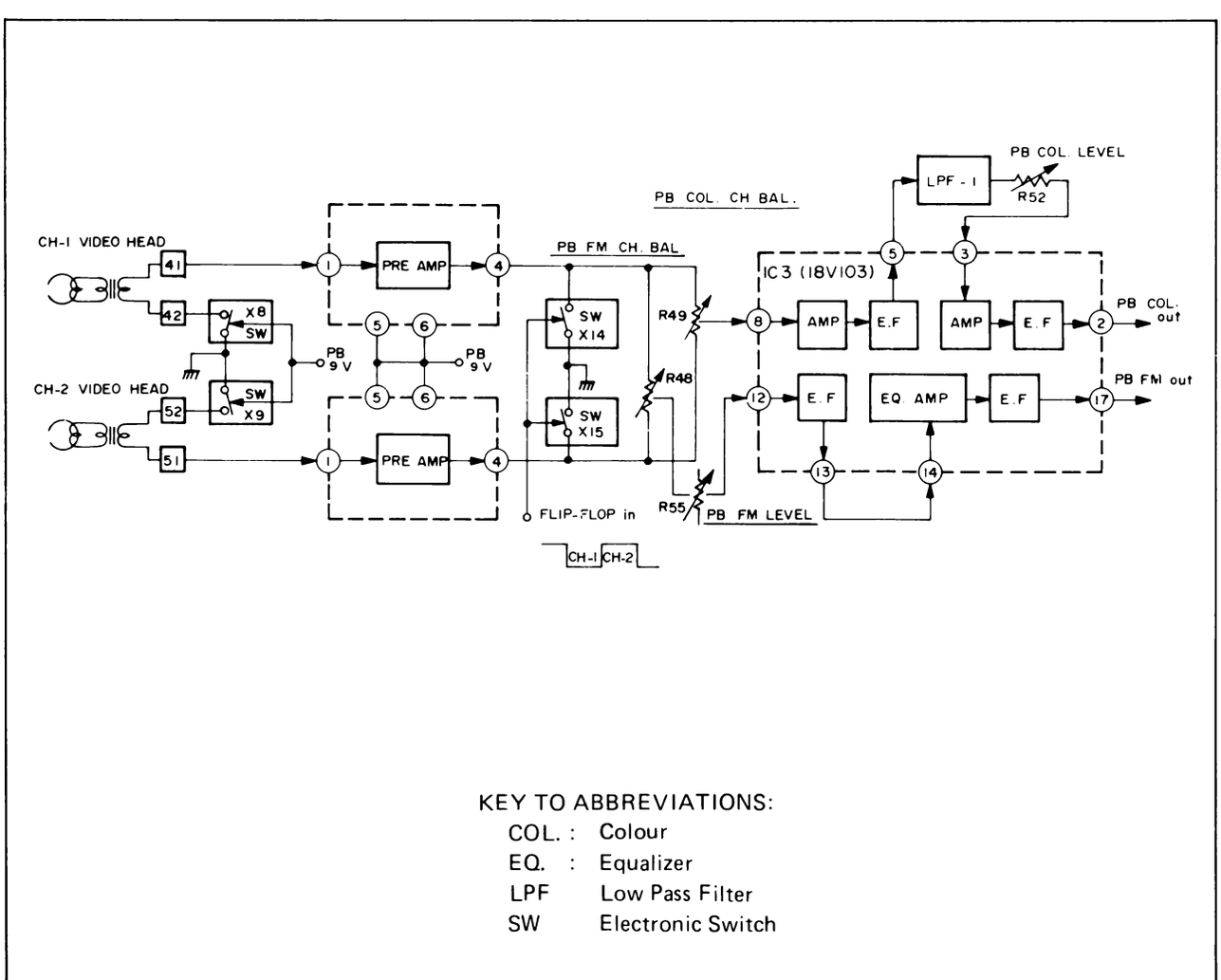



**Fig. 3-11** Characteristic of LPF-201

### 3.2.4 Luminance and colour signal playback system

Refer to Fig. 3-12.

During playback the regenerated FM signal from both video heads is amplified by the preamplifier, IC1 and IC2 (PRE/REC board) of CH-1 and CH-2. The pre-amplifiers are switched by a symmetrical square-wave




KEY TO ABBREVIATIONS:

| | | |
|---|---|---|
| COL. | : | Colour |
| EQ. | : | Equalizer |
| LPF | | Low Pass Filter |
| SW | | Electronic Switch |

**Fig. 3-12** Block diagram of luminance and colour signal playback system-1

generated by two fixed magnets on the rotary head drum assembly. This switching permits the two FM signals to be combined. The output of the FM switching (SW) is sent to the luminance equalizer (IC3), then sent to the luminance demodulator circuit on the luminance/colour circuit board.

On the other hand, the chroma signal is supplied to the LPF-1 (low-pass filter) after passing through the colour amplifier IC3. Only the 626.9 ± 500 kHz chroma signal passes through the LPF-1. After the colour signal level determined by R52 (P.B. COL. LEVEL). This signal is amplified by colour amplifier IC3, then sent to the luminance/colour circuit board.

1. PRE-AMPLIFIER

The playback signal obtained from a tape is approximately 1–2 mV in amplitude. This very low amplitude requires the circuit used as a preamplifier to be the high gain, low noise variety.

The signal is coupled across a rotary transformer to pin 1 of IC1. Capacitors C18 and C19 are adjusted to match the impedance of the video heads to the input circuit. Integrated circuits IC1 and IC2 constitute a pre-amplifier with cascade configuration which provides the high gain, low noise characteristic necessary. Figure 3-13 shows the overall response characteristics of the preamplifier.

The output from then are fed to the switcher X14, X15.

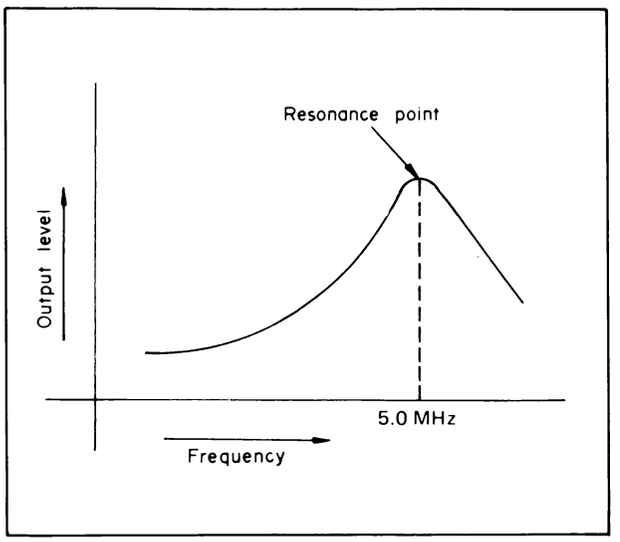



**Fig. 3-13** Frequency response of the pre-amplifier

2. SWITCHES (SW) X14 and X15

The VHS is a two-head helical scan machine. During record, each head is actually in contact with the tape for more than 180°, so each recorded video track is longer than one field. In playback it is necessary to switch from one head to the other, without mixing the FM signals.

Playback switching is illustrated in Figure 3-14.

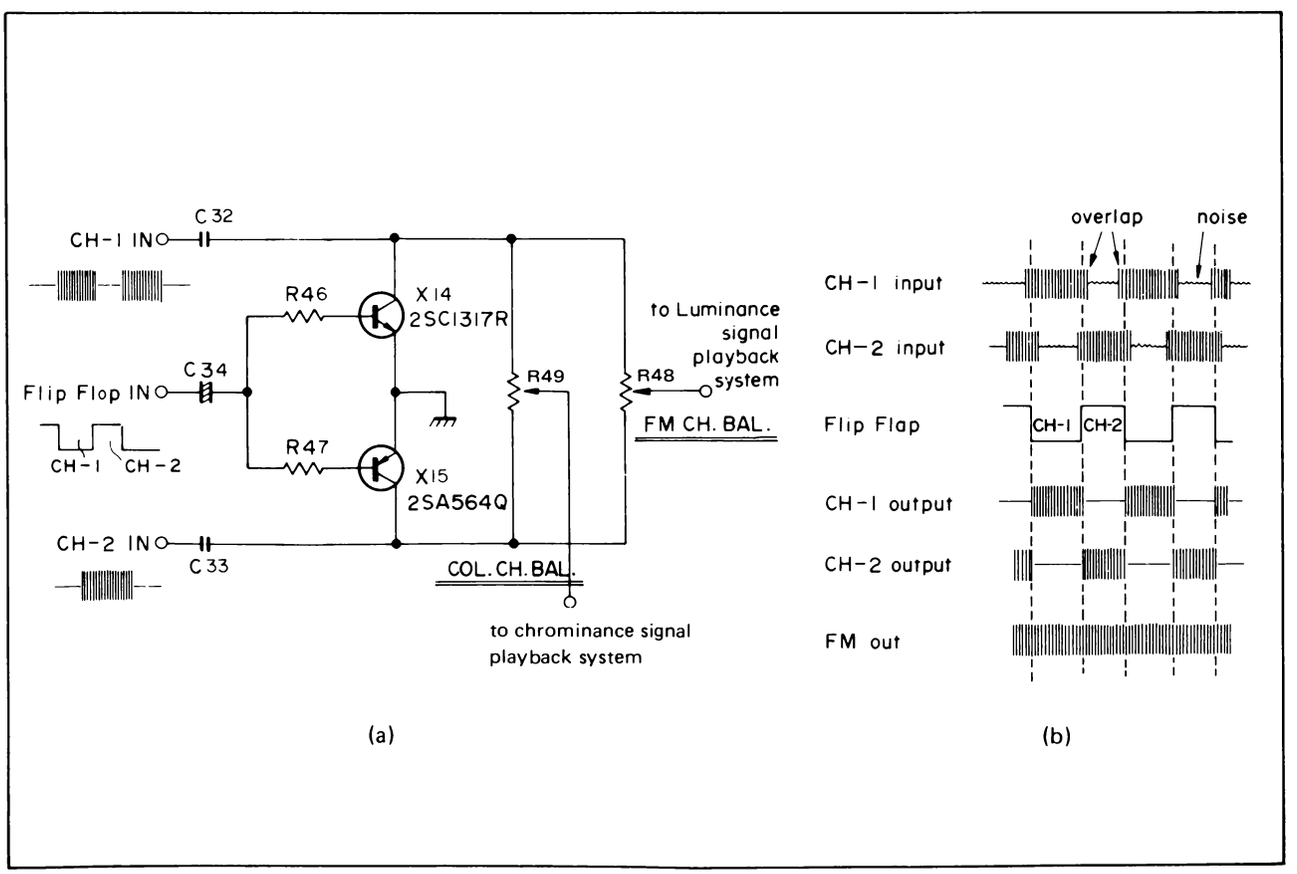



**Fig. 3-14** FM switching system

A signal is applied from CH-1 and CH-2 with every rotation of the video heads. Since mixing two FM signals presents may difficulties, a continuous signal is formed by the switching method.

The tape wrap in the drum is slightly more than 180° so there is a little overlap on the playback signal. Switching is accomplished as follows: Approximately 5-H before the leading edge of vertical sync, one channel has almost completed its signal path and the other is just beginning.

At this time 25-cycle square waves change polarity on the bases of the X14 and X15. When a positive part of gate pulse is applied to the base of X14, transistor X14 is turned on and shorts any signal on the collector to ground. However, transistor X15 is turned off by this positive gate pulse and any signal at the collector is passed to the resistive mixing network.

4. COLOUR AMP (IC3), LPF-1

After passing through the R49 (COLOUR CHANNEL BALANCE) the playback chroma signal is amplified by the Colour Amp (IC3), then sent to LPF-1 (Low-Pass-Filter).

The low-pass-filter eliminates all signals in the spectrum above approximately 1.5 MHz.

After passing through R52 the remaining signal 626.9 kHz ± 500 kHz is sent to colour circuit on the luminance and colour printed circuit board.

- R55 (PB FM LEVEL) is a potentiometer for playback FM level.
- R52 (P.B. COL. LEVEL) is a potentiometer for a playback colour level.

L6 (820 $\mu$H) and C39 (0.0056) are traps to check interference of audio bias at the after-recording.

### 3-2-5 Luminance signal reproduction system

Refer to Fig. 3-15.

The FM playback signal from the preamplifier is fed to an HPF after passing through the amplifier IC4. The HPF

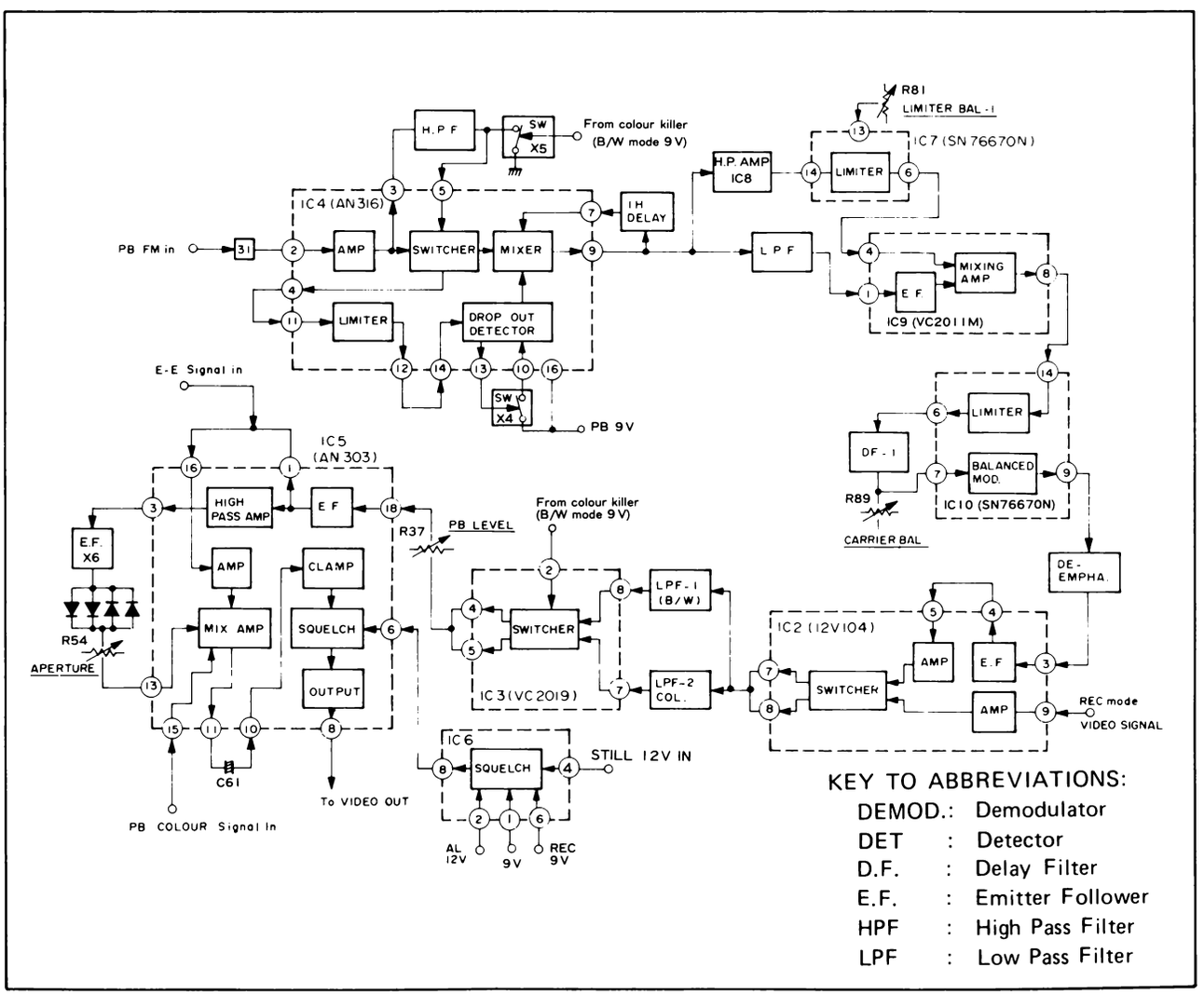



**Fig. 3-15** Block diagram of luminance signal reproduction system

eliminates the chroma signal then sent to the Mixer. The D.O.C. (Drop-out Compensator) eliminates drop-out caused by the loss of the FM signal due to damage or scratches on the magnetic tape.

After passing through the mixer, the FM signal is divided. The low component of the FM signal passes through a low-pass filter (LPF), and high component of the FM signal passing through H.P. AMP. The high component of FM signal is sent to limiter and mixed with the low component of the FM signal at the mixing amplifier IC9.

Although the signals have gone through several stages of limiting, the process of drop-out correction may introduce some additional amplitude variations. Therefore, a limiter is provided to remove amplitude variations entirely.

Integrated Circuit, IC10 (SN76670N) is a delay line type demodulator combined with DF-1 (DELAY FILTER), and demodulates the FM signal.

The demodulated signal is sent to a de-emphasizer which compensates its frequency characteristic (Contrary characteristic of pre-emphasis is recording), then sent to E.F. of IC2.

After passing through the AMP. IC2, signal sent to a SWITCHER which selects the playback signal path or record signal path. Then, this signal fed to LPF-1 and LPF-2.

Integrated Circuit, IC3 (VC2019) is an electronic switcher, when the colour signal appeared at pin 7 or 8 of IC2, video signal is first supplied to LPF-2 (Low-Pass-Filter) which rolls off at 3.3 MHz will pass through the SWITCHER of IC3.

When the black-and-white signal appeared at pin 7 or 8 of IC2, video signal is first supplied to LPF-1, which rolls off at 4.1 MHz will pass through the SWITCHER of IC3.

After passing through the SWITCHER, this video signal is determined its level by R37 (P.B. LEVEL), then sent to pin 18 of IC5, E.F.

After passing through R37 (P.B. LEVEL), the video signal is sent to the aperture, which compensates its higher frequencies.

The compensated video signal is mixed with the signal coming from IC5 (Amplifier) by IC5 (Mixing Amplifier) and also mixed with colour signal so as to be sent to the audio and servo circuit board as the video output signal.

The video signal which passed through the mixing amplifier is clamped by IC5 (Clamper) and will finally be the video output after passing the squelch output.

Electronic-to-Electronic mode, the video signal from the AGC output is supplied to IC5 (Amplifier) and finally sent to the video output through the mixing amplifier, clamper and squelch output.

1. AMPLIFIER (AMP), HIGH PASS FILTER (HPF) and MIXER – IC4 (AN316)
   Refer to Fig. 3-15.

This circuit eliminates drop-outs caused by the loss of the FM signal.

The playback FM signal is first supplied to pin 2 of IC4 to be amplified by an amplifier (AMP), then supplied to pin 3 of IC4. The amplified FM signal is supplied to the high-pass filter (HPF) made up of C37, C39 and L9 which passes through the FM signal component, then fed to pin 5 of IC4. The FM signal reaches pin 4 of IC4 after passing through a differential amplifier and an emitter follower, and then fed to pin 11 of IC4 after passing through C43, R40 and C46.

After passing through the limiter, the FM signal is fed to pin 12 of IC4 and supplied to pin 14 of IC4.

Then, the output signal of the drop-out detector of pin 13 of IC4 is sent through the low-pass-filter (LPF) made up of L10, C41 and C44, so a drop-out appears to be a pulse at the gate of X4 (Detector Drive) as a switching pulse.

This switching pulse is fed to pin 10 of IC4 drop-out detector (Drop-out Det). On the other hand, FM signal coming from pin 5 of IC4 is supplied to pin 9 of IC4 after passing through the emitter follower and the mixer. This output is always supplied through 1-H Delay Line (DL-1) to pin 7 of IC4. This 1-H delayed RF signal is mixed with the signal from the drop-out detector. Normally, the limiter and the drop-out detector circuit are not operating so that the delayed RF signal does not appear to the mixer. However, when a drop-out occurs, the drop-out detector sends a gate pulse to the mixer, so the delayed RF signal from the high-pass filter will appear at the mixer.

Note: DOC (Drop-out Compensator) detection sensitivity is decided according to the ratio of resistance distributions between R40 and R47.

2. Duplex Limiter circuit

As this model is designed to be affected more strongly by pre-emphasis than conventional models, so the FM modulated signal is apt to arise AM variation at the high frequency component of the video signal. If the FM signal is limited only once by a limiter, there occurs shortage of the FM signal which causes black-and-white reverse phenomenon as shown in Fig. 3-16.

Refer to Fig. 3-17.

High component of the signal which especially causes black-and-white reverse phenomenon is firstly picked up (in other words element of AM variation is eliminated) by H.P. AMP. composed of IC8, and then the picked up signal is limited by the first limiter (c).

At the same time lower component of the signal which also includes important information is picked up by LPF (d) (C51, L13, R50).

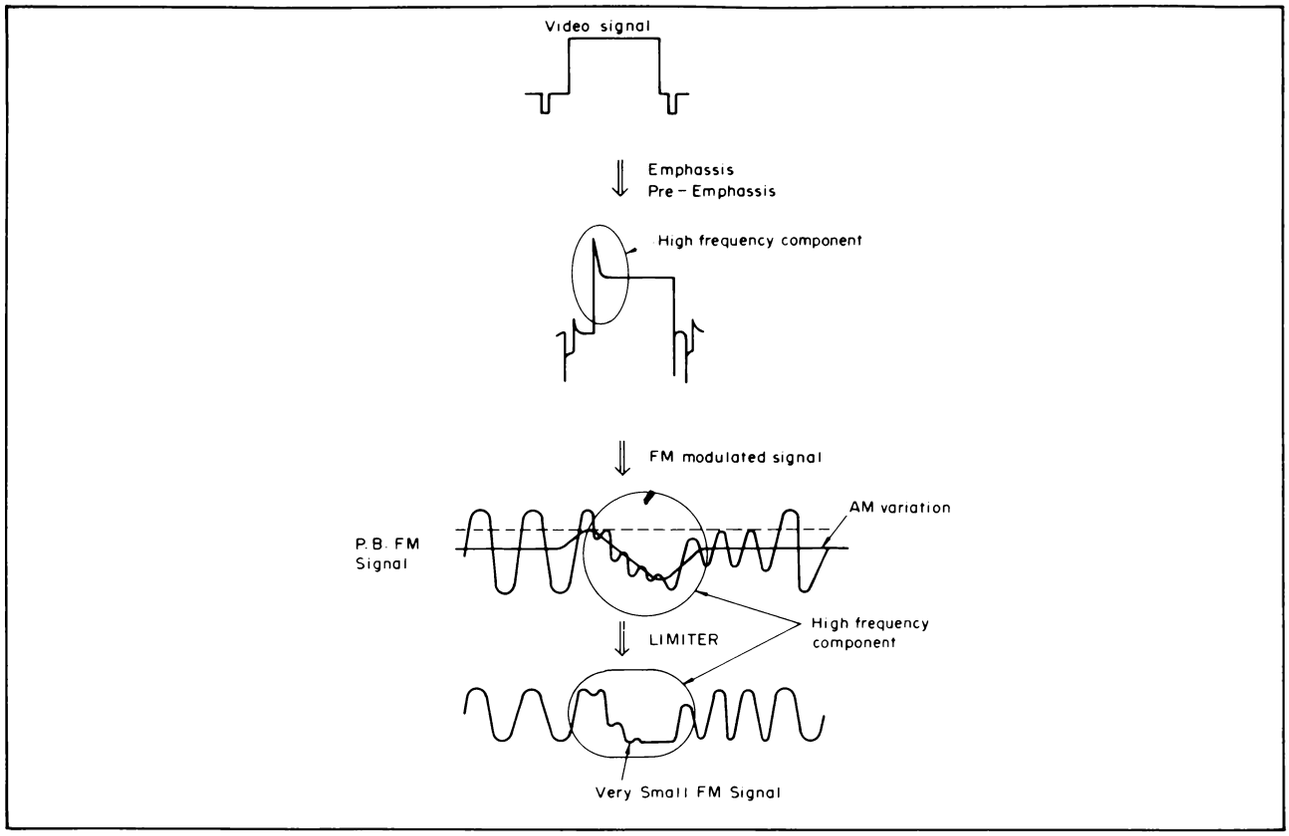



**Fig. 3-16** Limiter

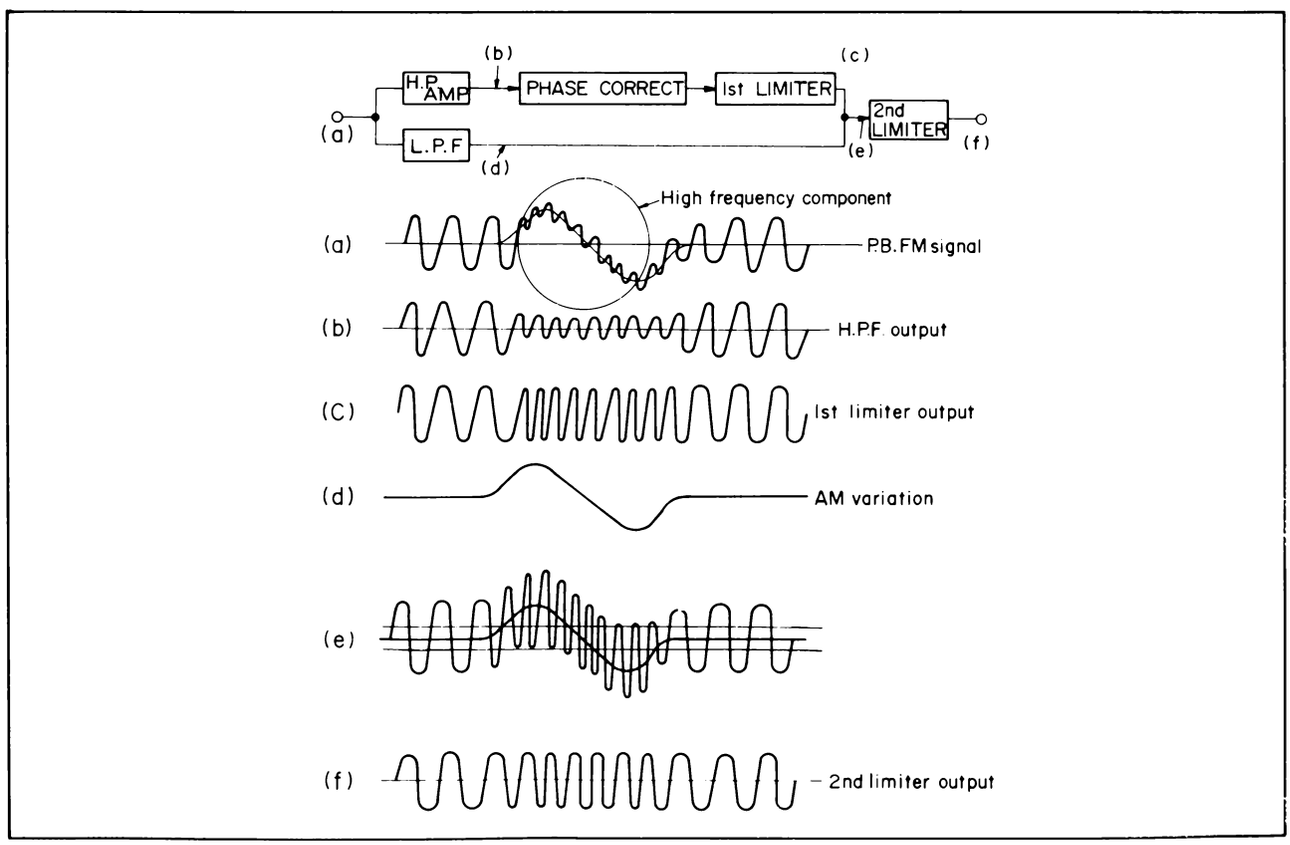



**Fig. 3-17** Duplex limiter

Both the elements are mixed by the mixing amplifier IC9 (e) and the mixed FM signal is sent to the second limiter IC10 (f) which is provided to remove amplitude variation entirely. This unit has two limiters in two stages for improving the signal-to-noise ratio and prevent the black-and-white reverse phenomenon.
Such the system is called the Duplex Limiter circuit.

3. De-modulator (IC20) (BALANCED MODULATOR)
The demodulation system employed in the HR-4100E is the delay line type phase detection demodulator consisting of IC10 and delay line DF-1.
All illustrations of the fundamental concept appear in Fig. 3-18, block diagram and corresponding waveforms, respectively.

4. DE-EMPHASIS, SWITCHER (IC2), LPF-1, LPF-2, SWITCHER (IC3)
At modulation in recording amplifier, higher frequency component of the video signal is emphasized by the pre-emphasis. De-emphasis is set in order to attenuate the emphasized high component by its characteristic contrary to that of pre-emphasis and to reduce noise in higher band at the same time.
De-emphasized is composed of R99, 100 and C100, 101, 103.
De-emphasized signal is supplied to E.F. and AMP. then supplied to SWITCHER which selects the video signal, record mode signal path or playback mode signal path, then sent to LPF-1 and LPF-2.
After passing through LPF-1 and LPF-2, signal sent to SWITCHER (IC3) which selects the colour mode signal pass (SWITCHER IC2 – LPF-2 – pin 7 of IC3, SWITCHER) or black-and-white mode signal path (SWITCHER, IC2 – LPF-1, pin 8 of IC3 SWITCHER).
Luminance signal which passed through LPF-1 or LPF-2 is supplied to IC5 after its level is determined byR37 (P.B. LEVEL).

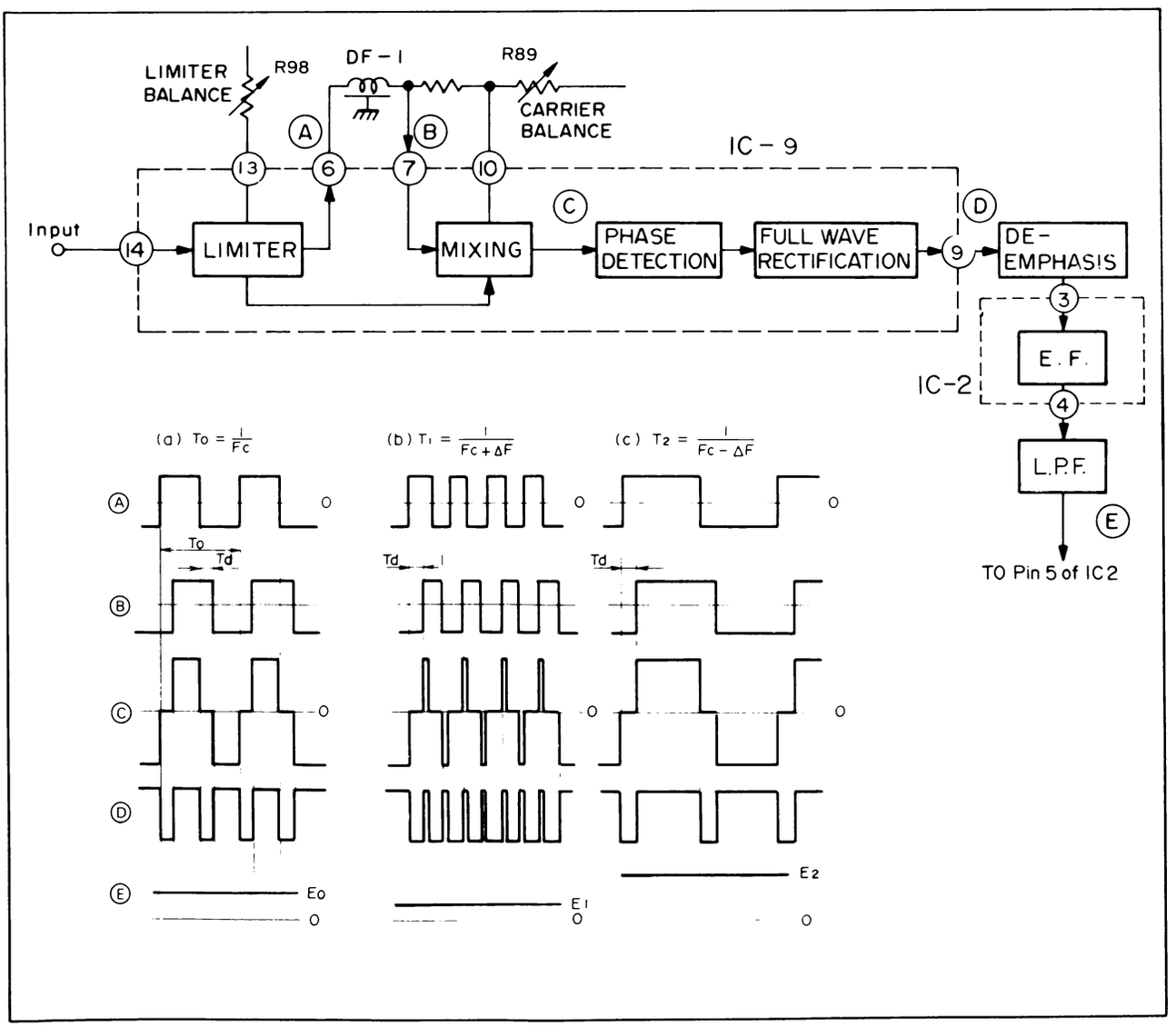



**Fig. 3-18** Demodulator block diagram and waveforms

5. NOISE SUPPRESSOR CIRCUIT – IC5

The playback luminance signal is supplied to pin 18 of IC5 and fed to pin 1 of IC5 through E.F. (Emitter Follower). This output signal devided into two signals, one whose high frequency component is attenuated by LPF (R60, C69) will be supplied to pin 2 of IC5. After passing through the high-pass amplifier (H.P. AMP), the high-frequency component appears at pin 3 of IC5. The other output is supplied to pin 16 of IC5. Also, in record mode, the electronic-to-electronic (E-E) signal is supplied to pin 16 of IC5. Output from pin 3 of IC5 is supplied to the emitter follower (E.F.) X6 and sents to D6–D9 to pick up its higher element than ± 0.3 V. R54 (Aperture) is set for adjusting the level of the higher element, and the adjusted element will be supplied to pin 13 of IC5.

The mixing amplifier mixes three signals, namely, one is the luminance signal from pin 16 of IC5, the second is playback colour signal from pin 15 of IC5 and the rest is the higher element of the luminance signal coming from pin 13 of IC5.

The mixed signal is picked up at pin 11 of IC5 and sent to pin 10 of IC2 through C61, then the video signal is supplied through the CLAMP, SQUELCH, OUTPUT.

6. SQUELCH – IC6 (8V301)

Refer to Fig. 3-19.

The circuit is designed to cut-off the video signal. When the pin 6 of IC5 is charged with voltage coming from connector 24, so that Tr 2 of IC6 is turned on and pin 8 of IC6 supplies low potential to pin 6 of IC5 SQUELCH, so that the SQUELCH will be released and video signal will be supplied to the OUTPUT.

In playback, when the loading arm reached to the end of loading, AL (After Loading) 12 volts power supply is supplied to pin 2 of IC6 through D1 of IC6 under the time constant of R2 of IC6 and C75, Tr 2 turns on and SQUELCH is released.

In the still mode, the STILL 12 volts power supply is supplied to pin 4 of IC6, so that the Tr1 of IC6 turned on and collector voltage is held ground potential.

Consequently, REC (Record) 9 volts does not be supplied to pin 6 of IC6. As a result Tr2 turns off and the SQUELCH will be functioning so the video signal is not supplied to the OUTPUT.

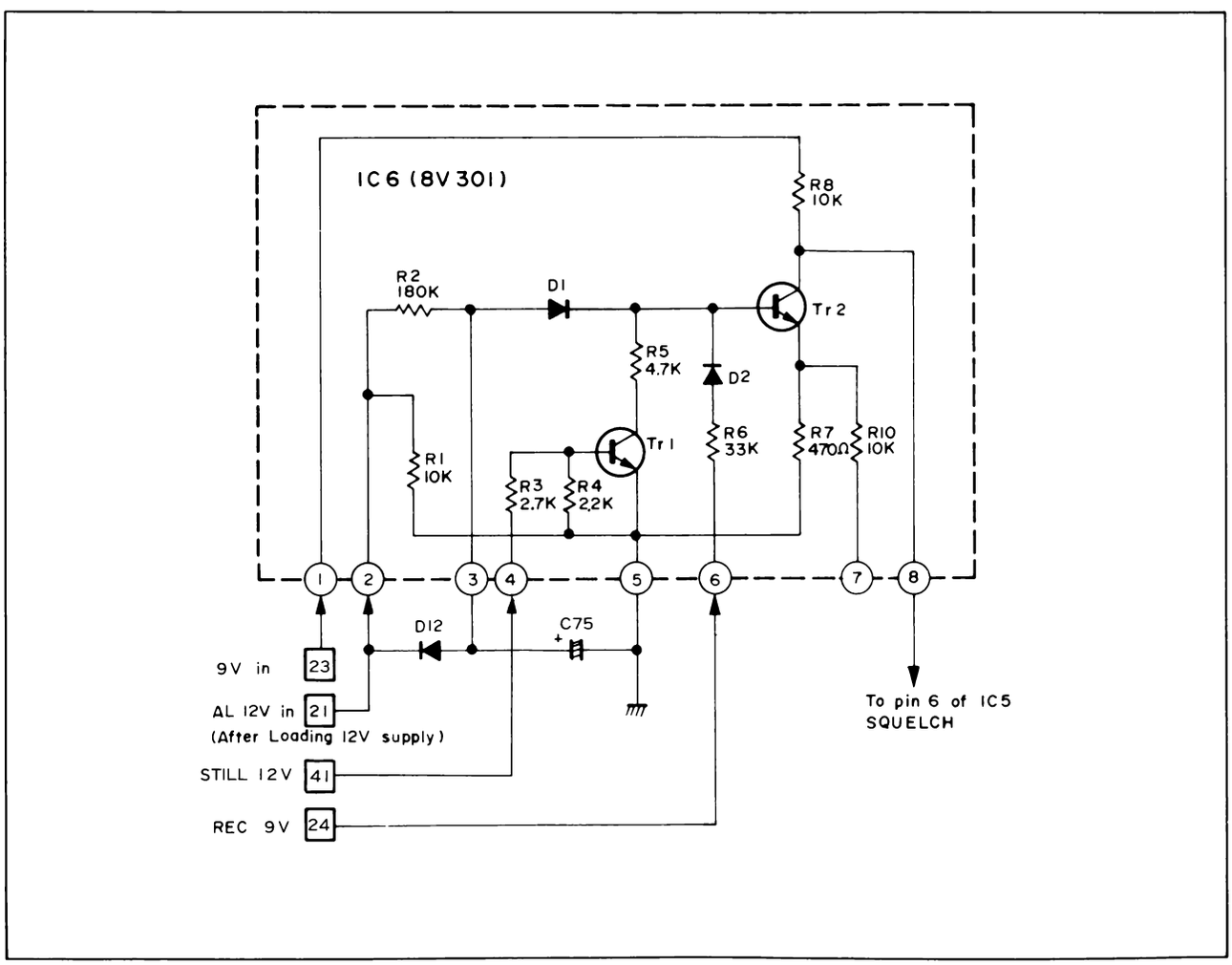



Fig. 3-19 Squelch

### 3.2.6 Couour signal playback system – Main path

Fig. 3-20 shows the block diagram of the main path of the colour signal playback system.

The playback colour signal from Preamplifier circuit board is supplied through IC201 (Amplifier) and E.F. to ACC (Automatic Colour Control). After passing through the ACC circuit, the colour signal is controlled to a constant level. Then the colour signal is supplied to the BALANCED MODULATOR which converts with the 5.06 MHz signal coming from Band-Pass-Filter (BPF-203). The signal from the BALANCED MODULATOR is fed to the band-pass filter (BPF-202), so that only the 4.43 MHz ± 500 kHz colour signal is sent to the emitter follower X204 (E.F.). Then the colour signal is supplied to X206 (AMP).

After passing through the emitter follower X204 (E.F.) the signal is supplied to DL202 (Delay Line) which eliminates cross-talk element of the signal component and improves its S/N ratio. After that, the signal is amplified by IC203 (Amplifier) and then supplied to the killer amplifier.

After passing through the killer amplifier the colour signal is sent to IC5, then it is mixed with luminance signal to be the video out signal.

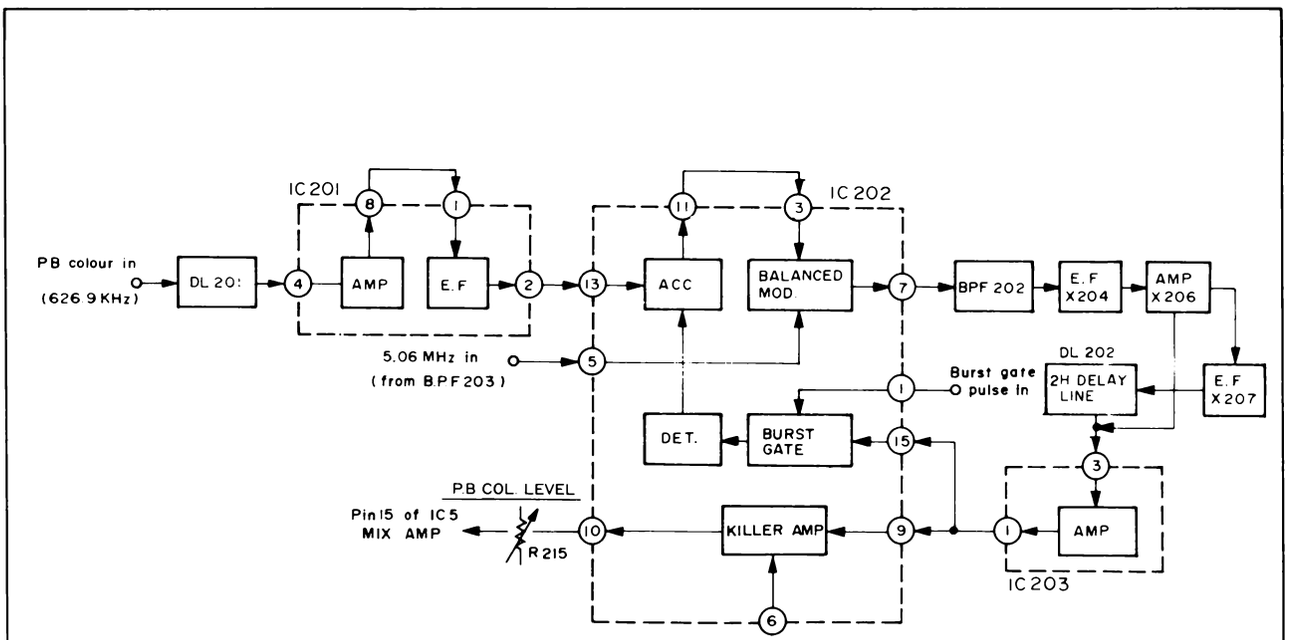
1. ACC – IC202 (AN305)

Playback colour signal from IC201 (Emitter Follower) is sent to pin 13 of IC202 Automatic Colour Control (ACC). ACC control system is as follows.

The colour signal amplified by IC203 is fed to pin 15 of IC202 GATE, and the burst separator pulse is supplied to pin 1 of IC202, so the burst signal which is separated from a colour signal is sent to ACC detector.

The ACC detector detects the burst level into DC potential, this DC voltage change is supplied to ACC circuit as a control voltage.

The ACC circuit in playback is in operation by detecting the peak value of the burst level of the playback signal. The colour signal which was controlled to have constant burst level by the ACC circuit is converted in its frequency by the main converter. As a result, both sum and difference frequencies will appear. The difference element (4.43 MHz ± 500 kHz) of colour signal is picked up by BPF-202.




KEY TO ABBREVIATIONS:

| | | |
|---|---|---|
| ACC | : | Automatic Colour Control |
| BPF | : | Band Pass Filter |
| D.L. | : | Delay Line |
| E.F. | : | Emitter Follower |
| SW | : | Electronic Switch |
| 2H | : | two Horizontal Scanning Lines |

**Fig. 3-20** Colour signal playback system (Main path)

## 2. 2-H DELAY LINE FILTER (DL202)

Refer to subsection 1-7-6 and 1-7-7.

Its function is to pass only 4.43 MHz (+ 500 kHz) colour signal. The circuit is composed of 2-H delay line and straight line as shown in Fig. 3-21(C).

In the VHS colour recording system, the following is shown in recording.

CH-1 track: Colour phase is recorded with normal phase.

CH-2 track: Colour phase is recorded with delaying 90° every 1-H.

Fig. 3-21 (A) shows video recording pattern.

Fig. 3-21 (B) shows colour recording phase.

Fig. 3-21 (C) shows playback colour phase.

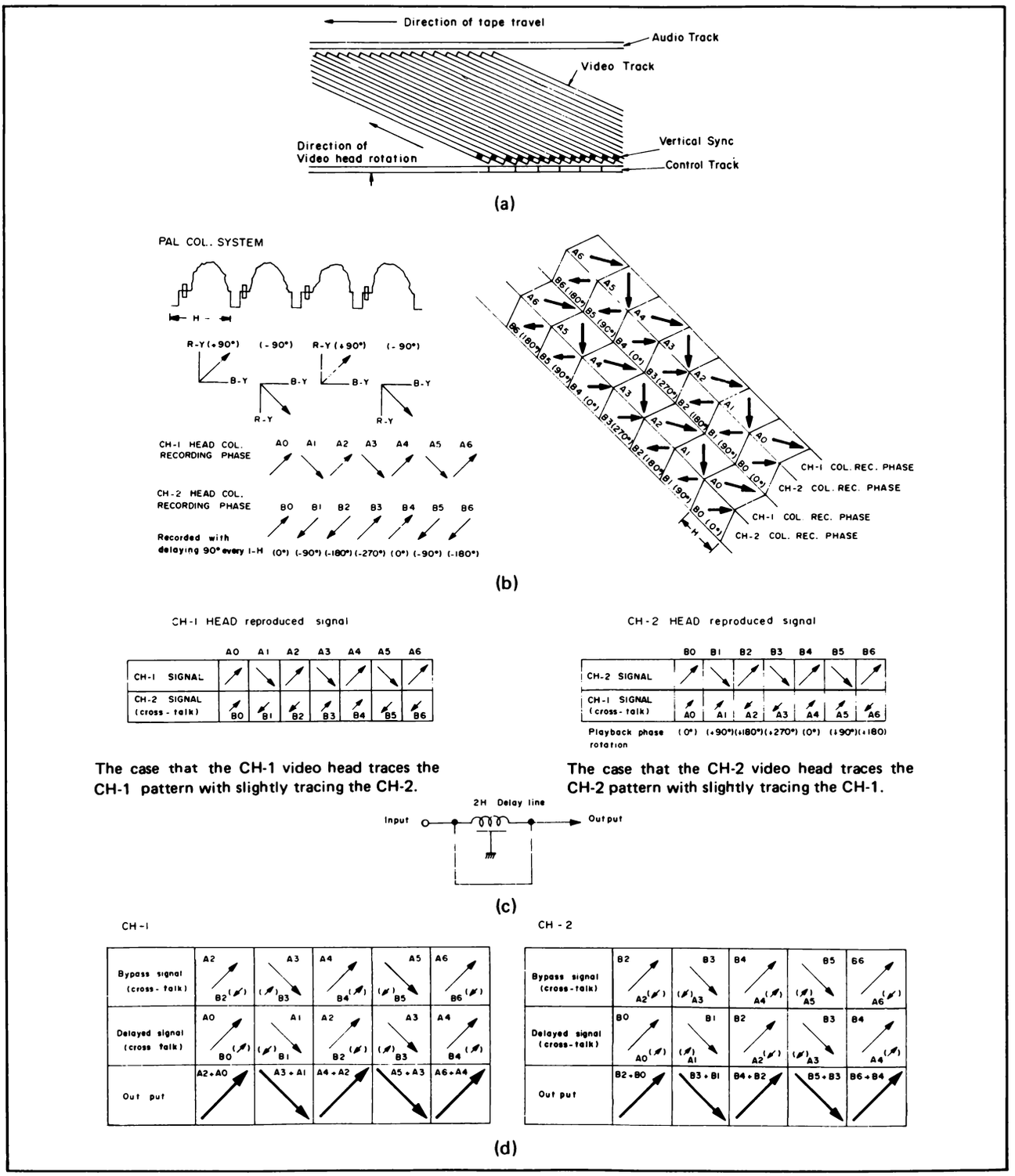



**Fig. 3-21**

The phase of the main signal for CH-1 is shown as in the figure, while the phase of cross-talk signal for CH-2 turns 90° every 1-H.
The signal is supplied to 2-H delay line filter. The main signal (CH-1) becomes a complex vector and the cross-talk signal is cancelled as shown in Fig. 3-21 (D). In other words, cross-talk signal is eliminated by the 2-H delay filter.

3. COLOUR KILLER AMPLIFIER (KILLER AMP) – IC202 (AN305)

The colour signal whose cross-talk element has been eliminated by the 2-H delay filter is supplied to the colour killer amplifier (IC202).
Refer to Fig. 3-22.
The colour killer amplifier is controlled by DC potential coming through pin 6 of IC202 being supplied by the killer detector IC205 (KILLER DETECTOR). When the pin 6 of IC202 is charged with high voltage (8 V DC, approx.) which is colour mode, the killer does not work and the colour signal passes through the killer amplifier and is supplied to pin 10 of IC202. In case of B/W signal, pin 6 of IC202 is charged with low voltage (0 V DC, approx.) and the killer is in operation, so no colour signal (actually that is, black-and-white signal leakage or noise components) appears at the pin 10 of IC202.
The colour signal passing through the colour killer amplifier is supplied to IC5 (AN303) which mixes it with luminance signal to make it the final video output signal.
The above is a description on the main signal of the colour signal playback system, and the following is described on APC system of colour signal playback.

### 3.2.7 Colour signal playback system – automatic phase control (APC) system

Refer to Fig. 3-23.
In recording mode, the automatic phase control (APC) system is not operating and the VXO (Variable Crystal Oscillator) works as a fixed oscillator to oscillate 4.43 MHz signal which is supplied to the BALANCED MODULATOR (IC208). On the other hand, the BALANCED MODULATOR is supplied with a 625 kHz signal from the AFC system to convert its frequency, and the converted signal is sent to BPF-203 which picks up the sum element of the signal (5.06 MHz) to supply it to the BALANCED MODULATOR (IC202).
In the playback mode, the automatic colour control (ACC) supplies 626.9 kHz ± $\Delta f$ signal which includes such fluctual elements as jitter to the BALANCED MODULATOR (IC202). At the first stage the automatic phase control (APC) loop is not in operation yet and the variable crystal oscillator (VXO) oscillates 4.43 MHz signal. This 4.43 MHz signal and the 625 kHz ± $\Delta f$ signal from AFC are both fed into the BALANCED MODULATOR (IC208). As a result, both sum and difference frequencies will be seen in the output. Then this output signal through the band-pass filter (BPF-203), so the only sum component (5.06 MHz ± $\Delta f$) is supplied to the BALANCED MODULATOR (IC202), and the 4.43 MHz (difference frequency component) can be taken out by the band-pass filter (BPF-202).

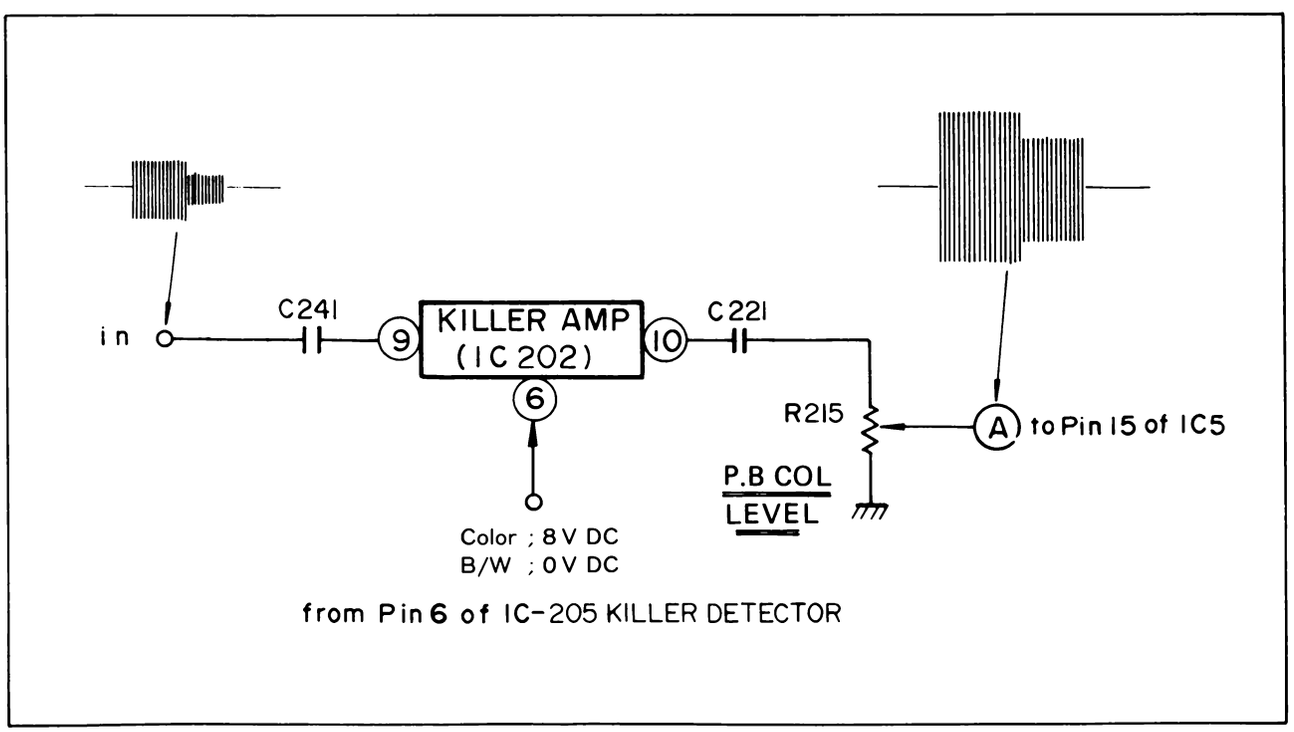
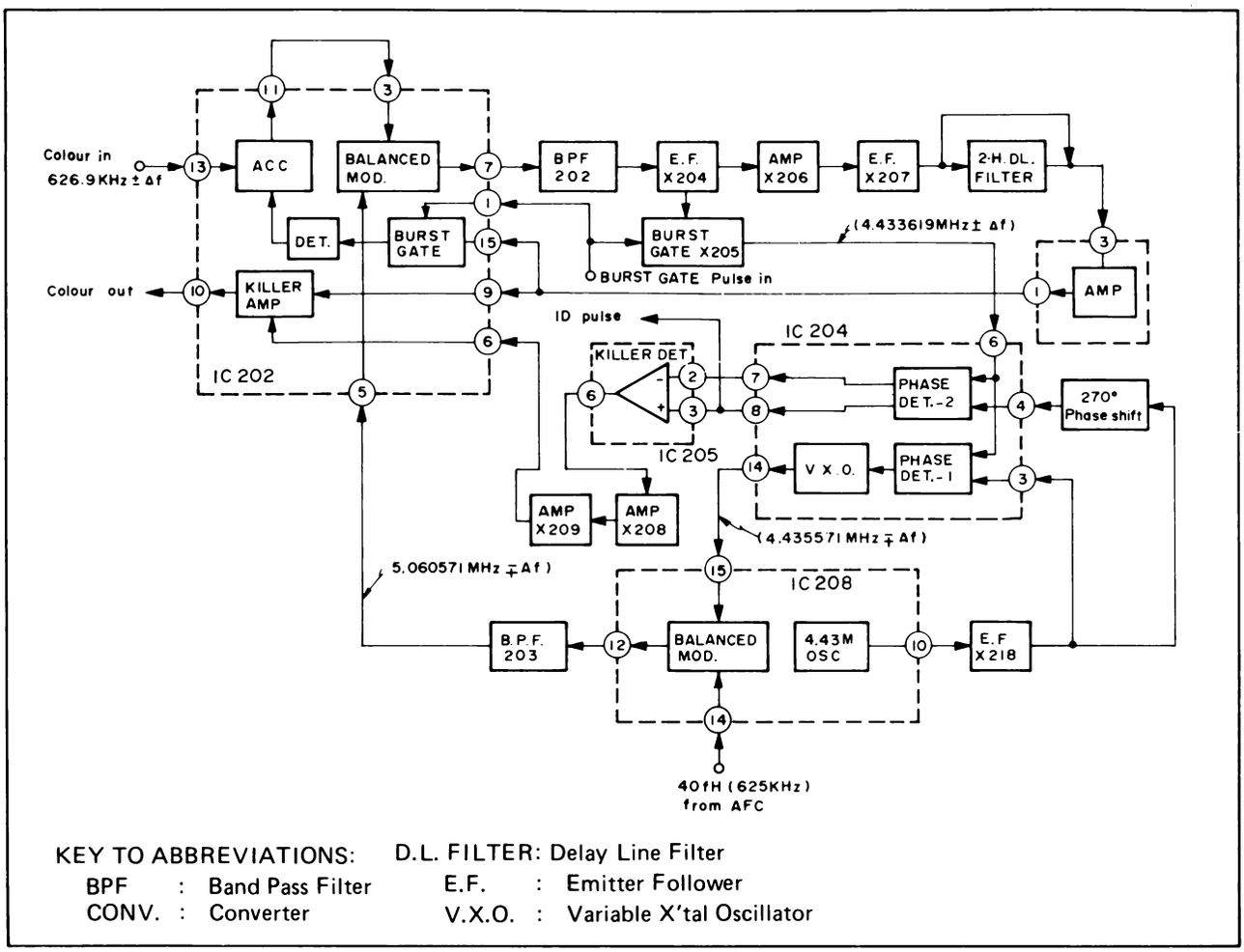



**Fig. 3-22** Colour killer amplifier




KEY TO ABBREVIATIONS:

| | | | |
|---|---|---|---|
| BPF | : Band Pass Filter | D.L. FILTER: Delay Line Filter | |
| CONV. | : Converter | E.F. | : Emitter Follower |
| | | V.X.O. | : Variable X'tal Oscillator |

**Fig. 3-23** Block diagram of automatic phase control (APC) system

On the other hand, the picked up 4.43 MHz $\pm\Delta f$ signal is supplied to the burst gate of X205, which picks up only burst signal of the colour signal and supplies it to the phase detector-1 and -2 (PHASE DET-1 and -2).

The 4.43 MHz signal from the crystal oscillator, IC208 and 4.43 MHz $\pm\ \Delta f$ signal from the burst gate are suppiled to the phase detector-1 (PHASE DET-1) which compares the phase of two signals and sends the error voltage to the variable crystal oscillator (VXO). Consequently, 4.43 MHz $\pm\ \Delta f$ signal comes out of the variable crystal oscillator to be supplied to BALANCED MODULATOR (IC208) and the band-pass filter (BPF-203) from which 5.06 MHz $\pm\ \Delta f$ signal is supplied to BALANCED MODULATOR (IC202).

After passing through APC system, the colour signal is obtained as the correct and stable 4.43 MHz (±500 kHz) output at the band-pass filter (BPF-202) output.

(5.06 MHz $\pm\ \Delta f$) – (625 kHz $\pm\ \Delta f$) = 4.43 MHz

Both the burst signal from the burst gate X205 and continuous 4.43 MHz waveform from the IC208 are supplied to the phase detector-2 (PHASE DET-2). These two signals are compared in phase each other at the phase detector-2 (PHASE DET-2), and, if there is normal phase shift between them, a plus voltage is generated at the output.

The voltage is supplied to the killer detector (KILLER DET.) IC205 and high voltage output sends to the killer amplifier IC202 (Killer Amp.), so the colour signal (4.43 MHz ± 500 kHz) passes through to IC5 as the playback colour signal. On the other hand, if there is a difference of 180° phase-shift between the two signals at the phase detector-2, negative pulse is supplied to automatic frequency control (AFC) through the X217. This pulse is called ID Pulse (Identification Pulse).

As described above, APC functions in three ways, namely,

- Phase control of colour signal,
- Colour killer function by phase detection,
- AFC control with ID pulse.
  (Refer to Section 3-2-8 for details.)

### 1. CRYSTAL OSCILLATOR – IC208

This circuit operates only in playback, then it oscillates 4.433619 MHz signal correctly. This signal is supplied to the phase detector-1 and -2 (PHASE DET-1 and -2).

2. BURST GATE – X205

Refer to Fig. 3-24.

The playback colour signal is supplied to a gate of X205 through C231 and the burst gate pulse is supplied to the other gate of X205 through R230.

Accordingly, X205 is on (amplifying) only in receiving the burst gate pulse and burst signal appears at the drain.

Components L203, C233 and R231 compose the 4.43 MHz resonance circuit, and D203 and D204 work as the limiter.

This burst signal is supplied to the phase detector.

3. PHASE DETECTOR-1, -2 – IC204

The 4.43 MHz signal from the crystal oscillator and playback burst signal are supplied to the phase detector-1 (PHASE DET-1), and detects the phase shift between the signals. Refer to Fig. 3-25.

The phase detector-1 (PHASE DET-1) monitors the phase relationship between the 4.43 MHz signal from the crystal oscillator and the burst signal from the playback colour signal and converts any phase shift into a voltage change. This voltage change is then fed to the variable crystal oscillator (VXO). To illustrate the operation of the phase detector-1 (PHASE DET-1), we will assign the following definitions.

The 4.43 MHz $\pm \Delta f$ signal from the burst gate is = $f_2$

The 4.43 MHz reference signal from the crystal oscillator is = $f_1$

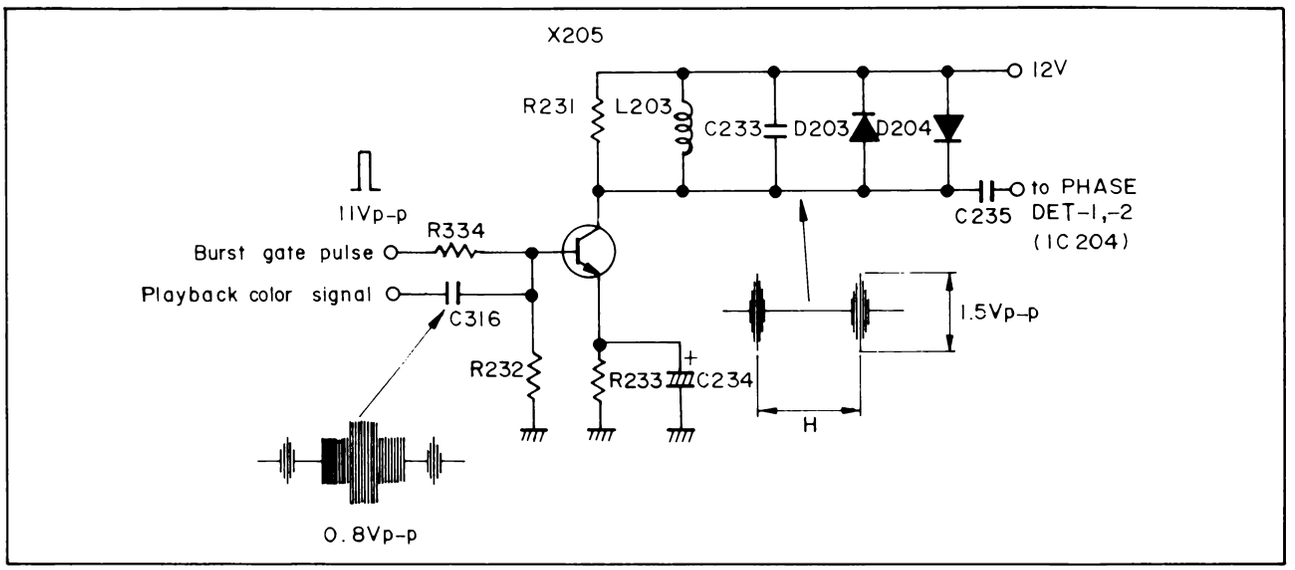



**Fig. 3-24** Burst gate

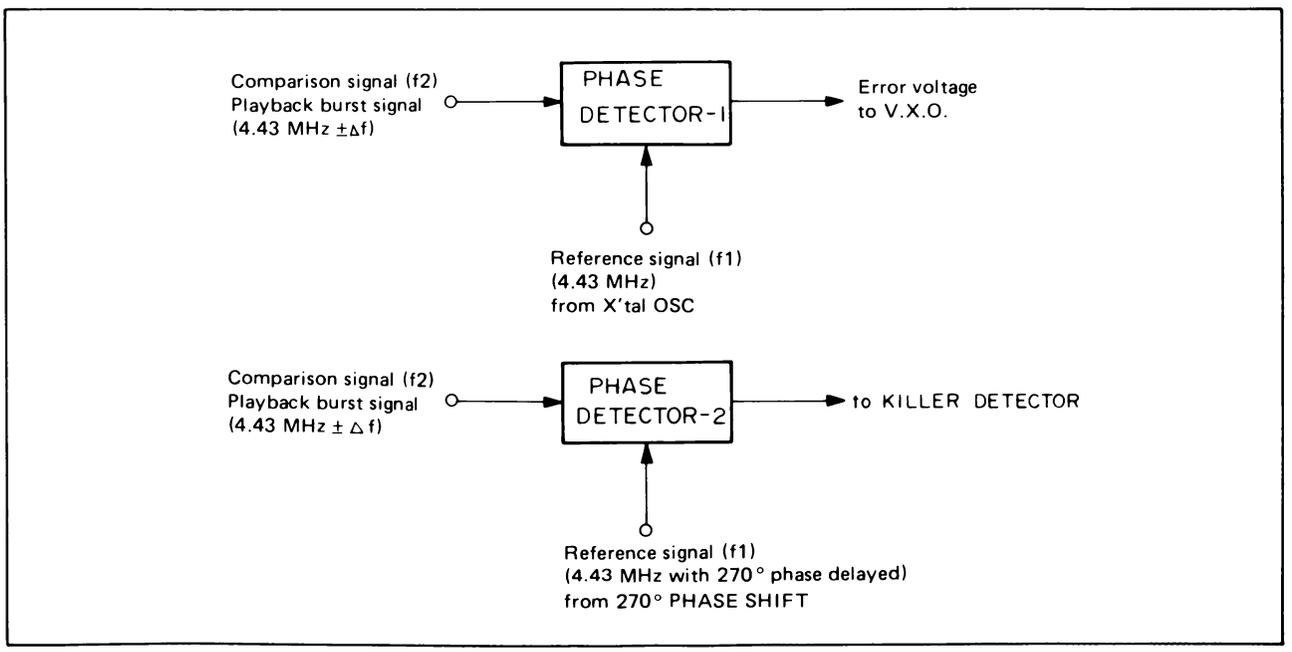



**Fig. 3-25** Phase detector

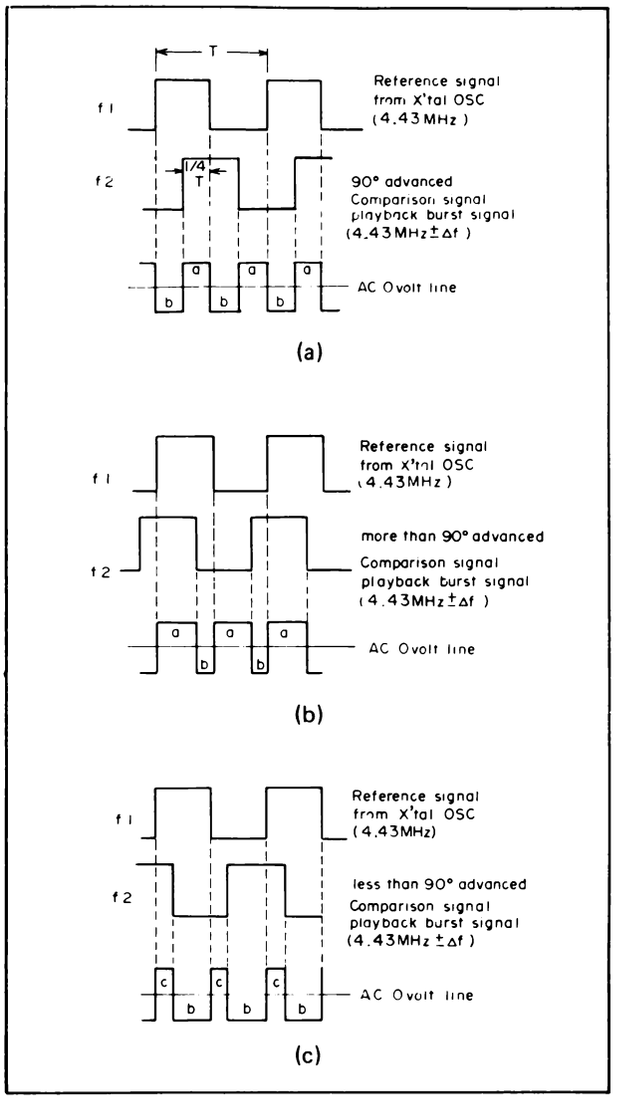



Fig. 3-26

Dependent upon the phase relation between these two signals, the following outputs are obtained from the phase detector-1 (PHASE DET-1).

In the case, the phase relation of $f_2$ (the burst signal from playback colour signal) advanced 90° to that of $f_1$ (4.43 MHz signal from the crystal oscillator), the output waveform shows the positive area (a) and negative area (b) is equal against the AC 0 volt line as shown in the figure. Therefore, reference voltage is supplied to the variable crystal oscillator.

Refer to Fig. 3-26 (b).

In the case, the phase relation of $f_2$ (the burst signal from the playback signal) advanced more than 90° to that of $f_1$ (4.43 MHz signal from the crystal oscillator), the output waveform shows (a) < (b) against the AC 0 volt line as shown in Fig. 3-26 (b). Therefore, the positive voltage against the reference voltage is supplied to the variable crystal oscillator.

Refer to Fig. 3-26 (c).

In the case, the phase relation of $f_2$ (the burst signal from the playback signal) advanced less than 90° to that of $f_1$ (4.43 MHz signal from the crystal oscillator), the output waveform shows (a) > (b) against the AC 0 volt line as shown in Fig. 3-26 (c). Therefore, the negative voltage against the reference voltage is supplied to the variable crystal oscillator.

The relation between the output and phase difference of the phase detector-1 is shown below.

Refer to Fig. 3-27.

The phase detector-1 detects phase of the playback colour signal. In the case, if the phase relation of $f_2$ advanced 90° against the $f_1$, the output of phase detector-1 is zero (reference voltage). In the range of ± 90° centralizing that point +90°, the output voltage corresponding to phase difference between $f_1$ and $f_2$ is obtained.

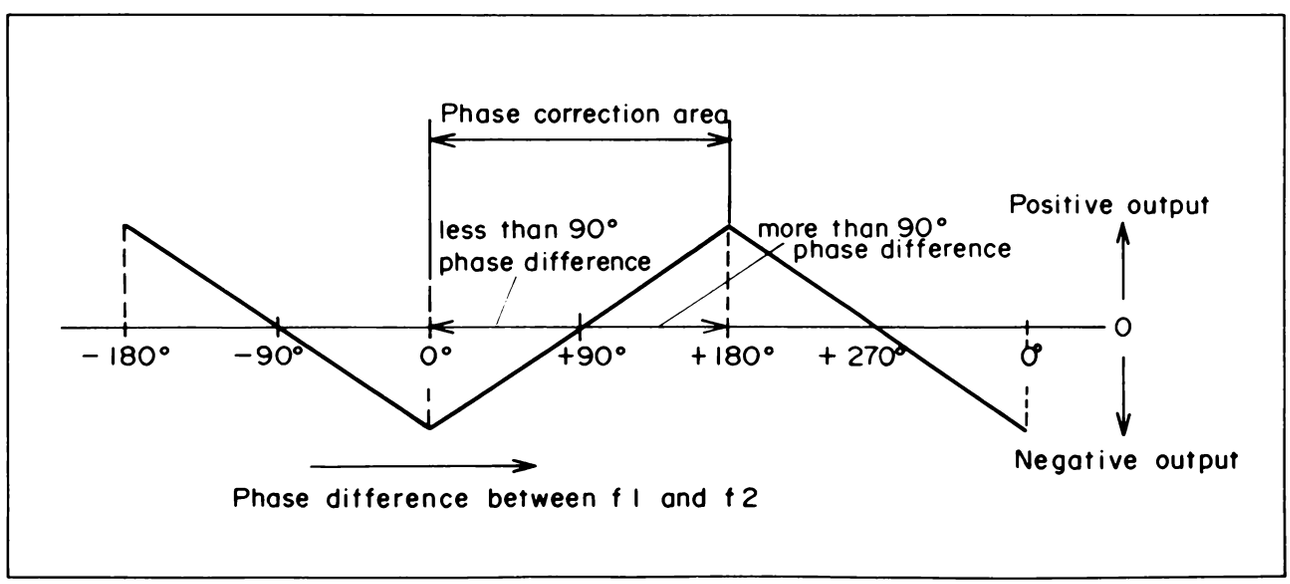



Fig. 3-27 Phase difference between $f_1$ and $f_2$

The phase detector-2 detects phase difference between them, and sends output signal to the colour killer circuit. The principle and output are the same as phase tector-1, but the 4.43 MHz signal from the crystal oscillator is 270° phase delayed by the 270° PHASE SHIFT.
This signal (270° phase advanced) is sent to the phase detector-2, so the relation between phase difference of $f_1$ and $f_2$ is shown in Fig. 3-28.

4. VARIABLE CRYSTAL (X'TAL) OSCILLATOR (VXO) – IC204

In Record mode, the crystal oscillator IC208 is not oscillating and no burst signal is supplied to the phase detector-1, the error voltage from the detector is "zero" (DC potential is nearly half of the power source voltage) which is supplied to VXO, and then it oscillates 4.43 MHz signal correctly. In Play mode, the oscillation frequency of the variable crystal oscillator (VXO) is controlled by the output of phase detector-1 (PHASE DET-1).
In Play mode, in case the phase relation of the 4.43 MHz signal from the playback burst signal is advanced 90° to that of the crystal oscillator signal, the output of the phase detector-1 is zero. Receiving this output, the variable crystal oscillator (VXO) oscillates constant 4.43 MHz signal correctly.
For example as shown in Fig. 3-29, if the phase relationship of P.B. burst signal is advanced (more than 90° advanced), the phase detector-1 output voltage is increased and this voltage is supplied to the VXO. This DC voltage controls oscillation of the VXO to delay the phase of 4.43 MHz signal.

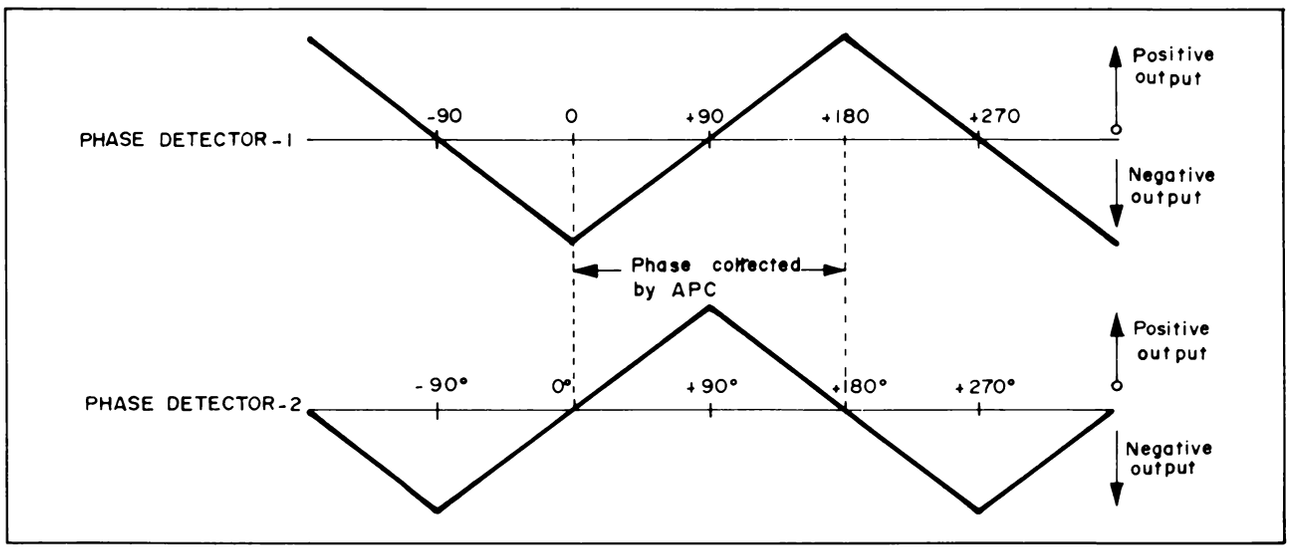



Fig. 3-28

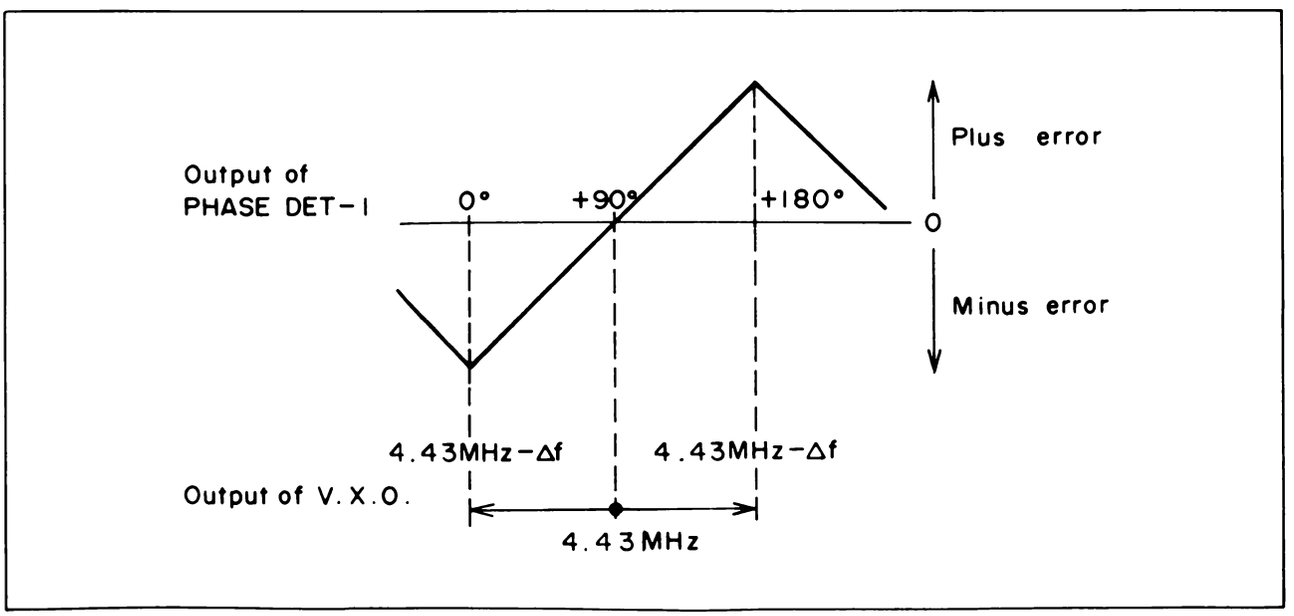



**Fig. 3-29** Oscillation of the VXO

The phase detector-1 and the variable crystal oscillator are connected each other inside the IC204.
Refer to Fig. 3-30.
The VXO compensation circuit is set to avoid frequency variation of VXO, which happens in the case that DC potential of the phase detector-1 output drifts with temperature.
The VXO is the differential type whose input is connected with two systems; one, pin 11 of IC204 is connected with C256 and its time constant is large, the other, pin 12 of IC204 is connected with C253, C254 and R252 and its time constant is small. In addition, pin 10 of IC205 is supplied positive horizontal sync signal, which makes switching of the two input signals.
Therefore, if there is voltage drift, the circuit works to cancel any potential difference between the two input signals of the variable crystal oscillator (VXO), then the output of the variable crystal oscillator (VXO) will be no frequency change. This signal is supplied to the pin 15 of the BALANCED MODULATOR IC208.

## 5. KILLER DETECTOR – IC205

The killer detector circuit is controlled by the output signal from the phase detector-2.
Refer to Fig. 3-31, the normal playback colour signal, phase difference at phase detector-2 is within ± 90° against centering at 180° and all the output of the phase detector-2 is positive output (DC voltage is positive from the reference value as shown in Fig. 3-28). This positive output is picked up through pin 8 of IC204, supplied to

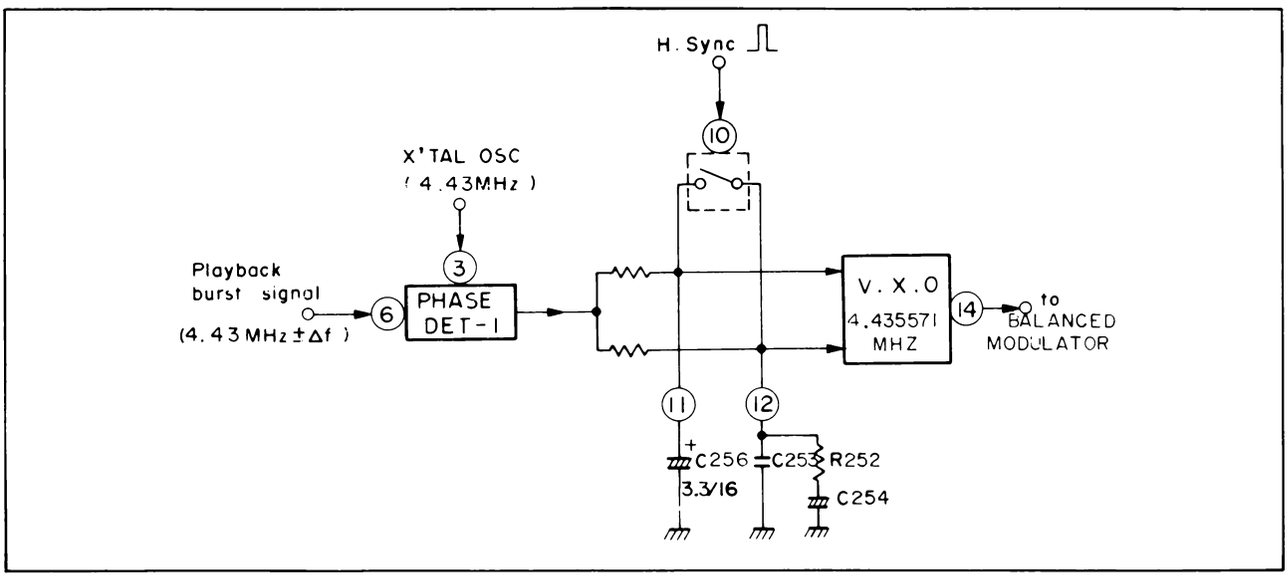



**Fig. 3-30** VXO compensation circuit

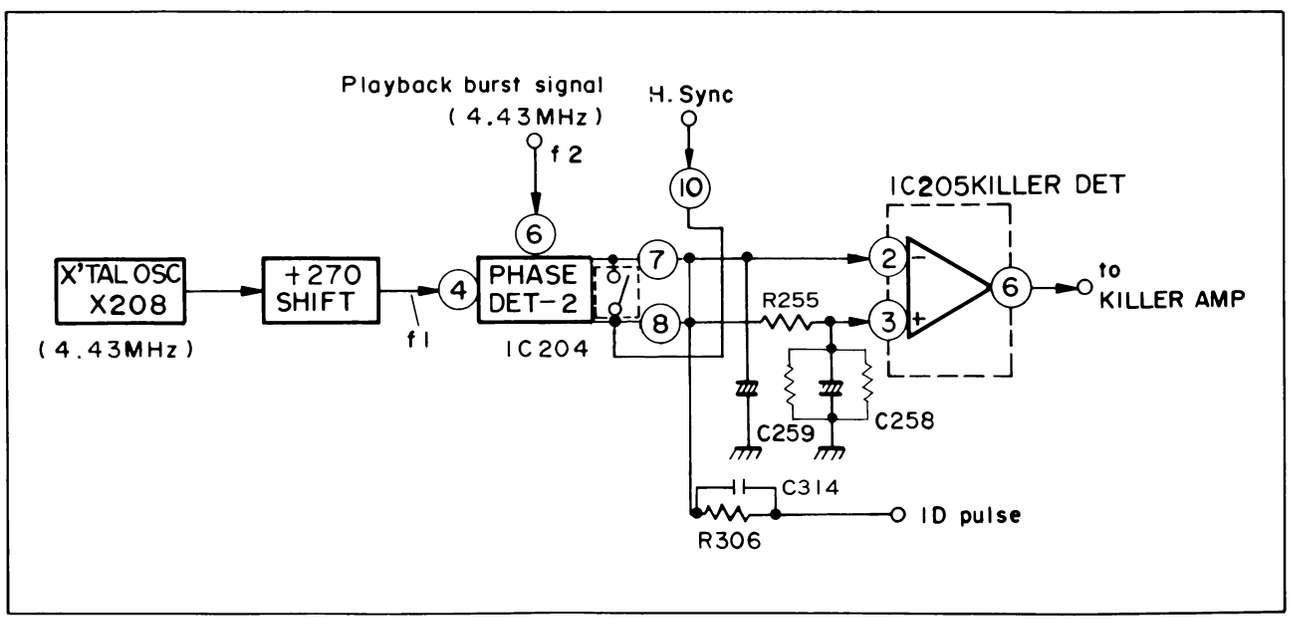



**Fig. 3-31** Killer detector

"positive input" of the killer detector through R255, then amplified there to be the output of high voltage is supplied to the killer amplifier, the colour signal is able to pass through the killer amplifier.
The output of the phase detector-2 is "zero", and there is no potential difference between two inputs to the killer detector. As a result pin 6 of IC205 is charged with low voltage (2 V DC approx.), and the colour killer starts operation to cut colour signals.
As described in the section of the variable crystal oscillator (VXO), by supplying horizontal sync pulse to pin 10 of IC204, potential difference between the two inputs to pin 3 and pin 2 of IC205 is cancelled. Components C259, R256, R338 and C258, all work for correct operation of the killer detector utilizing the difference of each time constant. The following is described on identification pulse (ID pulse) generation.
Refer to Fig. 3-27.
In the VHS PAL system, the phase of the CH-2 colour signal is rotated 90° every successive 1-H. If there is a difference between the timing in recording and in playback, the phase difference between $f_1$ and $f_2$ is considered to be more than ±90°.
The response range of the phase detector-1 detecting colour phase is between 0° and 180° in principle, (refer to Fig. 3-29), however, in actual there is a possibility to occur larger phase difference. In this case it is impossible to control the phase difference by the automatic phase control (APC) system.
Because of the automatic phase control (APC) system corrects within ± 90° phase difference between the 4.43 MHz signal from crystal oscillator and playback burst signal.
Therefore, by utilizing the phase detector-2 which generates ID pulse when the phase difference is more than ± 90°, AFC system is controlled by receiving the minus output coming through R306 to base of X217 and the phase turns to normal phase.
This is the function of ID pulse. For details of ID pulse, refer to the section of "AFC".

### 3-2-8 Automatic frequency control (AFC) system

Refer to Fig. 3-32.
AFC system takes the same action both in recording and playback except the reference signal. In recording the reference signal is the horizontal sync pulse of the input video signal while the horizontal sync pulse of the playback video signal in playback.

The functions of AFC system:

- to generate 40 x fH (15.625 kHz)
  (40 x 15.625 kHz = 625 kHz)
- to make the 40 fH signal rotate every 1-H at CH-2.
- to compensate phase control of the colour signal receiving ID pulse.
- to make complete compensation with input horizontal sync pulse.

The horizontal sync pulse of the reference signal is supplied to pin 10 of IC207 of the monostable multivibrator which forms the signal to square waveform, then it is picked up through pin 14 of IC207.
This output is supplied to pin 7 of IC208 AFC PHASE DETECTOR as a reference horizontal (fH) signal.
On the other hand, 160 fH (2.5 MHz) signal is oscillated by the voltage control oscillator (VCO) (IC208).
This signal is picked up at pin 17 of IC208 and supplied to pin 6 of IC207 (1/4 COUNT DOWN) where the signal is counted down to 1/4 and sent to the 1/10 and 1/4 count down, so that the only fH signal is picked up through the pin 2 of IC207 and supplied to the pin 8 of IC208, AFC PHASE DETECTOR as a comparison fH signal.

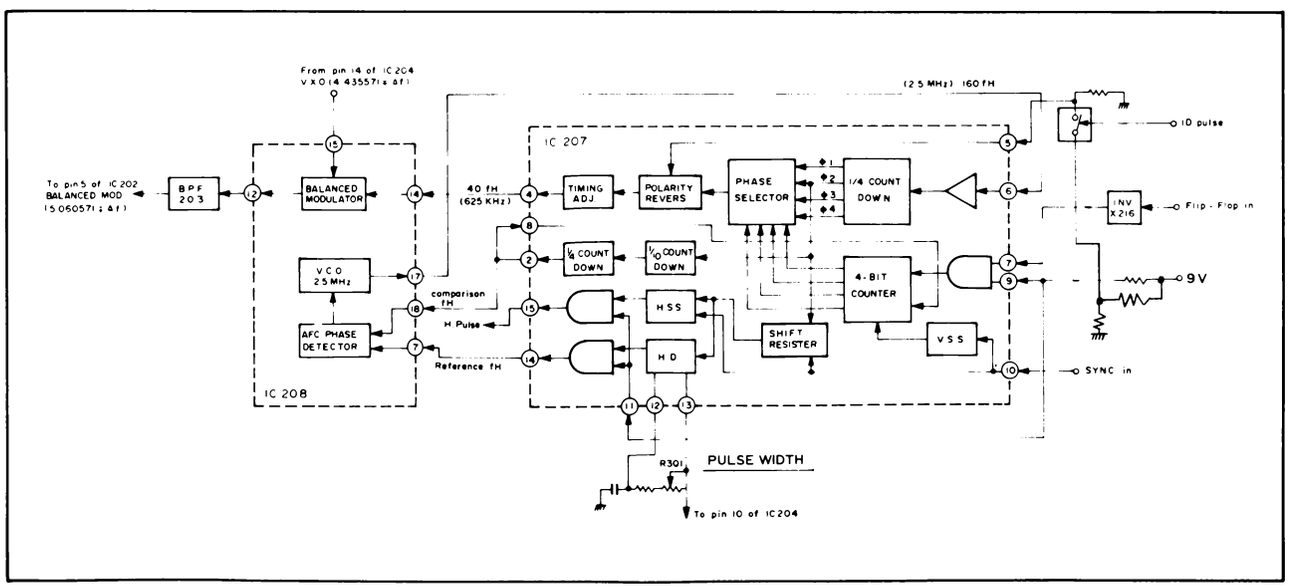



**Fig. 3-32** Block diagram of AFC system

The AFC PHASE DETECTOR (IC208) detects the phase of the reference fH (Sync signal) and comparision fH to generate error voltage, which will be fed to VCO (Voltage Control Oscillator) for oscillating correct 160 fH (2.5 MHz) signal.
Namely, there is generated 160 fH which synchronizes perfectly to input fH.
This 160 fH signal is supplied to pin 6 of IC207, 1/4 COUNT DOWN and PHASE SELECTOR which is the most important part of AFC that generates 40 fH (625 kHz) signal and rotates it by 90° every 1-H at CH-2 and normal phase at CH-1.
The 40 fH (625 kHz) signal generated in the above manner is supplied to pin 14 of IC208 (BALANCED MODULATOR), where frequency conversion of the signal is made with 4.43 MHz element coming from V.X.O. After that, sum element of the signal (5.06 MHz) is picked up by BPF-203 and finally the element will be supplied to pin 5 of IC202 (BALANCED MODULATOR).
All the signals concerned to the IC are shown in Fig. 3-32. The AFC system operates in the same manner both in recording and playback. In explaining on the side of CH-1, the colour signal phase is normal every 1-H and the CH-2 colour signal phase delayed 90° ever 1-H in recording, while in playback the original colour signal can be reproduced by advancing 90° every 1-H at CH-2.

2. ID pulse (Identification pulse)
In playback, however, there is a fear that the reference horizontal sync signal may be distorted owing to drop-out or switching point. For example, there might be a interference pulse supplied at a part of waveform.
In this case, this interference signal is detected with the comparison fH signal at the AFC phase detector and error voltage controls the VCO (Voltage Controlled Oscillator), so that the VCO oscillates the incorrect frequency.
Then the final output colour signal phase difference is more than 90° to the normal recorded colour phase. In such the case it cannot be compensated by APC system because it functions within 90° and it is hopeless to obtain normal playback colour signal.
Therefore, there arises the necessity of an ID pulse which controlls the AFC system to obtain the normal colour phase.
Namely, when there occurs advance or phase difference by more than ± 90°, the phase detector-2 generates a low pulse. This pulse (ID pulse) supplied to pin 5 of IC207 POLARITY REVERSE to reverse the output colour signal phase. Then after timing runs back to the normal condition. Regarding the reason why ID pulse is generated when the phase difference is more than ± 90°, refer to the subsection 3-2-7 (3) and (5).

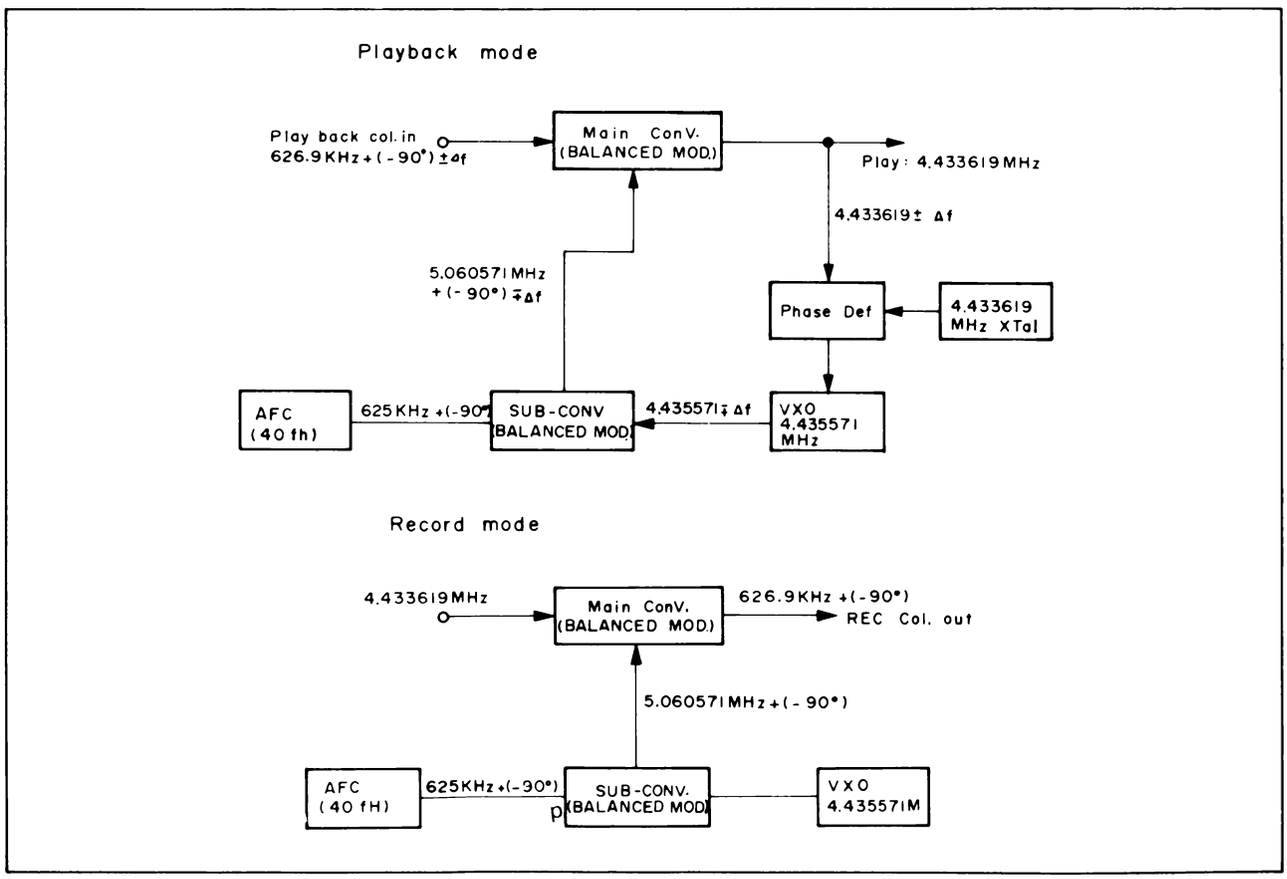



Fig. 3-33

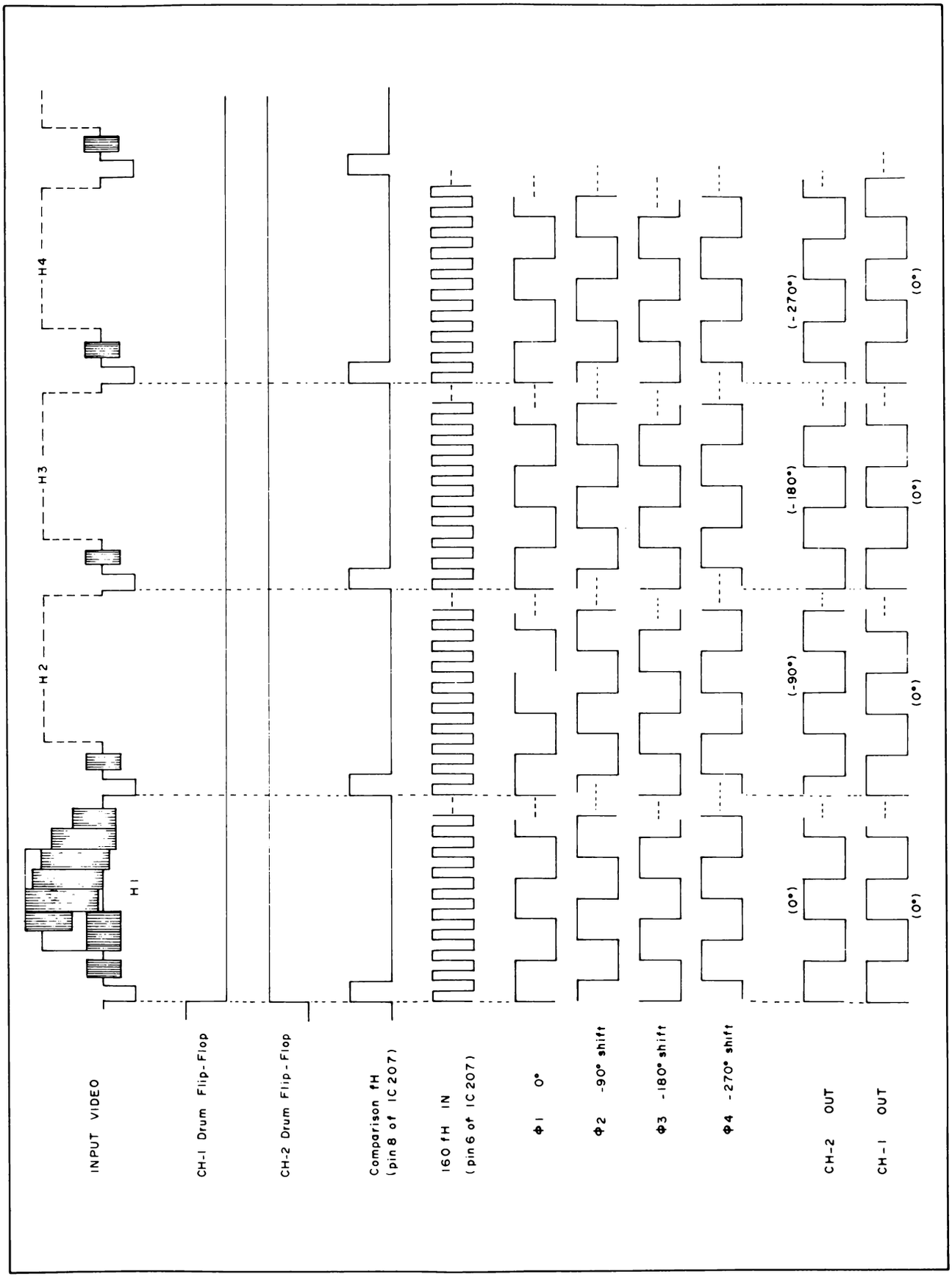



**Fig. 3-34** Timing chart

4. Record colour killer

When the "VHS" is recording a black and white signal as input, there is no burst present in the signal. At this time the output of the record colour killer is a high positive voltage which is sent to the switchers. In other words, in black and white signal mode the switcher switches the filter to record FM signals in order to utilize the recording band of VHS system as effectively as possible.

The signal from ACC is first amplified by X210 and then supplied to the burst separator X211. The burst signal is picked up by X211 and detected by D210 and D211 so that DC voltage may be obtained. The obtained DC voltage is supplied to the operational amplifier (comparator) IC206.

The DC potential at the pin 2 of IC206 is the threshold voltage for killer and it is adjusted by R283.

The output of IC206 is supplied to the electronic switch X212, whose collector is the output of Rec. colour killer and the output is high voltage (approx. 8 V DC) as the black-and-white signal.

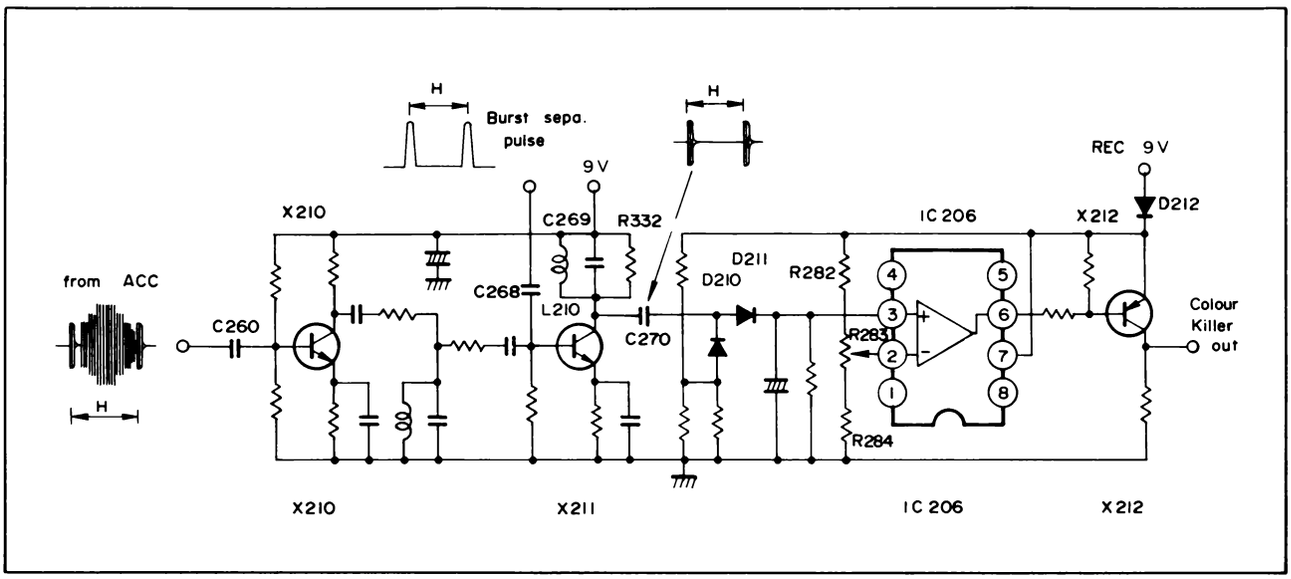



**Fig. 3-35** Burst separator and comparator

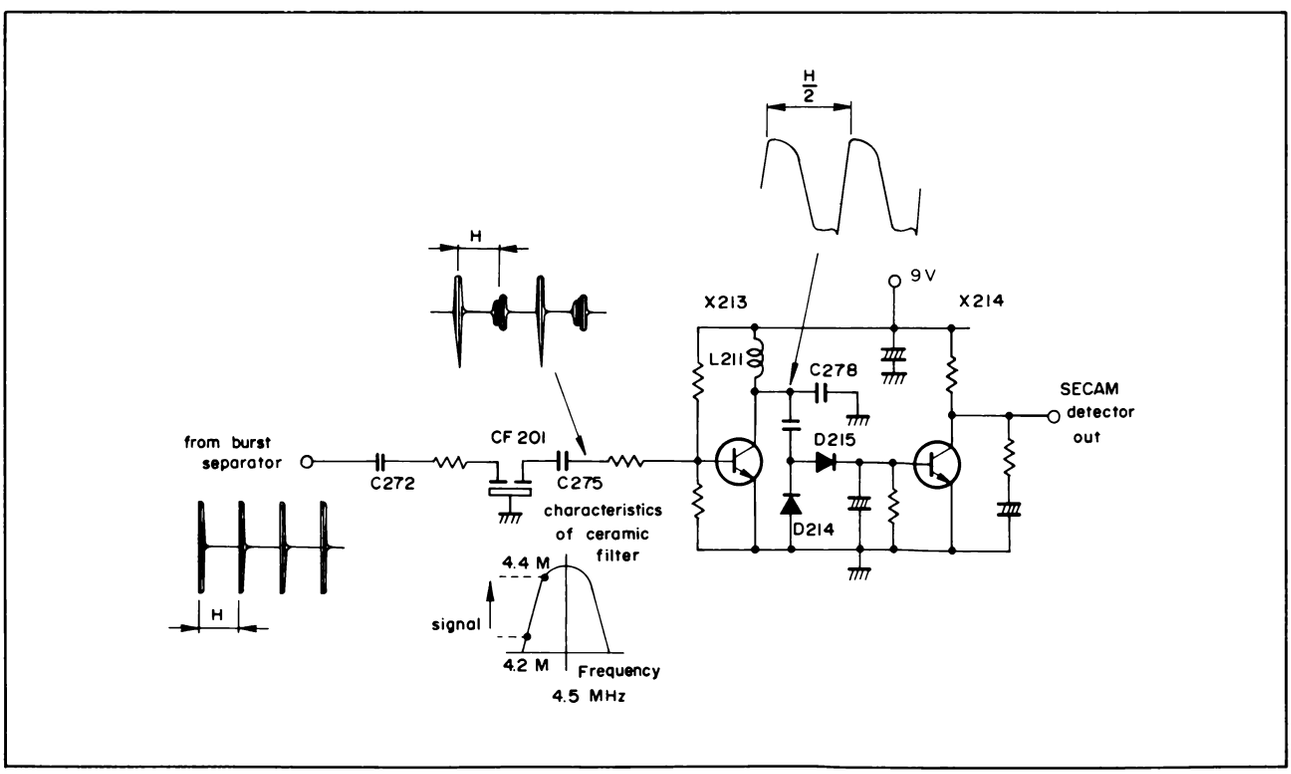



**Fig. 3-36** SECAM detector

5. SECAM detector

Colour signal and colour subcarrier sampling are applied in burst separator circuit X211 without regard Recording or Playback mode.

Tuning circuit is contained at the collector of X211 for 4.3 MHz colour subcarrier centre frequency. When SECAM signal is present at this point, colour subcarrier can be sampled as shown in the figure.

This subcarrier alternates every 1-H (1 horizontal scanning line period) between 4.25 MHz and 4.4625 MHz. When this signal goes through the ceramic filter (CF201) which processes 4.5 MHz center frequency, level difference appears at 4.4625 MHz and 4.25 MHz. The resulting signal alternates between strong and weak every 1-H. Envelope then becomes H/2 (approx. 7.8 kHz) by X213, L211 and C278. This 7.8 kHz envelope is applied to detector circuit D214 and D215 across the C277 and converted into DC voltage.

Consequently, in presence of SECAM signal, the 7.8 kHz enveope becomes detected and DC voltage applied to X214. Colour circuit is switched to SECAM system.

## 3.3 SERVO CIRCUIT

### 3.3.1 General

A circuit which controls frequency of rotation, phase or position of a mechanism is generally called a servo circuit. By this definition, the circuits of the HR-4100E which control the phase of the rotary video heads, capstan speed and hence the speed of video tape are called servo circuits. On Model HR-4100E, servo circuits are provided for controlling the phase and speed of the rotary video head drum and maintaining the proper speed of the rotating capstan, that is, the tape speed. The HR-4100E's servo control has two parts: "drum servo" and "capstan servo". In the Record mode, the drum servo system maintains constant relative position between the video heads and the vertical sync signal of the input video signal, and keeps the rotating frequency of the capstan constant. In Playback mode, the drum servo system maintains the relative position between the video heads and the reference signal. The reference signal is a control signal, reproduced from the control track of the video tape. This permits accurate reproduction of the video signal recorded on the tape. For controlling the tension of the video tape, the HR-4100E is provided with a mechanical system.

### 3.3.2 Capstan servo system

Reference signal oscillator IC2 and crystal produce a stable 3.58-MHz oscillation signal employed as a reference for the capstan servo control system. After waveform shaping by inverter (1/6 IC2), the signal is supplied to binary counter (IC3–10) for count-down.

A comparison signal is obtained by detecting capacitance variations of a frequency generator (FG) gear mounted on the capstan flywheel. This signal is amplified by FG amplifier X1, operational amplifier (op-amp) IC1 and inverter 1/6-IC2, which also remove AM fluctuation components. The signal is differentiated by C8 and R13, after which it is applied to IC3 pin 10 to become a positive pulse for counter reset.

IC3 is a binary counter. Its output becomes completely reset to LOW when a positive pulse is applied to pin 11. The input is pin 10, to which 3.58 MHz is applied. A 1/2" counted-down input pulse (approx. 1.74 kHz) appears at pin 15, while a $1/2^{14}$ counted-down input signal (approx. 1.74 kHz) appears at pin 3.

Transistor X2 is a sawtooth generator. Diodes D5 and D8 in the base circuit of X2 form an AND gate, that is, when D5 and D8 are completely cut-off, C10 becomes charged through R18 and R19. Capacitor C10 is discharged when one input of AND gate is LOW potential.

The timing chart is shown in Fig. 3-37.

In Record and Play modes, servo lock is obtained when the reset pulse (FG signal) is positioned at location 5 of the IC3–15 output waveform. In other words, the width of the pulse, from the fifth positive pulse period of the IC3, pin 15 counter output to the point at which the reset pulse is received, becomes the control voltage (that is, C10 charging time). This pulse is clampled to B+ line by D17 and R13, resulting in an inverted DC voltage.

Only the DC component of voltage variation is obtained through a low pass filter, after which the impedance is converted by 1/5-IC5 (voltage follower) and the signal is amplified by an op-amp. The resulting signal goes to motor drive amplifier for driving capstan DC motor.

As an example, if the comparison frequency (366-Hz FG frequency) declines, the C10 charging time increases and e ($= kt_1$) pulse increases. Consequently, $E = (9 - kt_1)$ decreases. When this pulse is amplified and its polarity converted, it will serve to increase motor rotation.

**A. Tape Speed**

Tape speed adjustment is performed by potentiometer R19, which varies the time constant of the C10 charging circuit.

**B. Electronic Switch**

Transistor X5 turns on with forward base bias. The motor drive amplifier then becomes reverse biased and the motor stops. The forward bias is applied to X5 by either of the following two means:

1) PAUSE key pressed during Play mode

2) Dew sensor operation

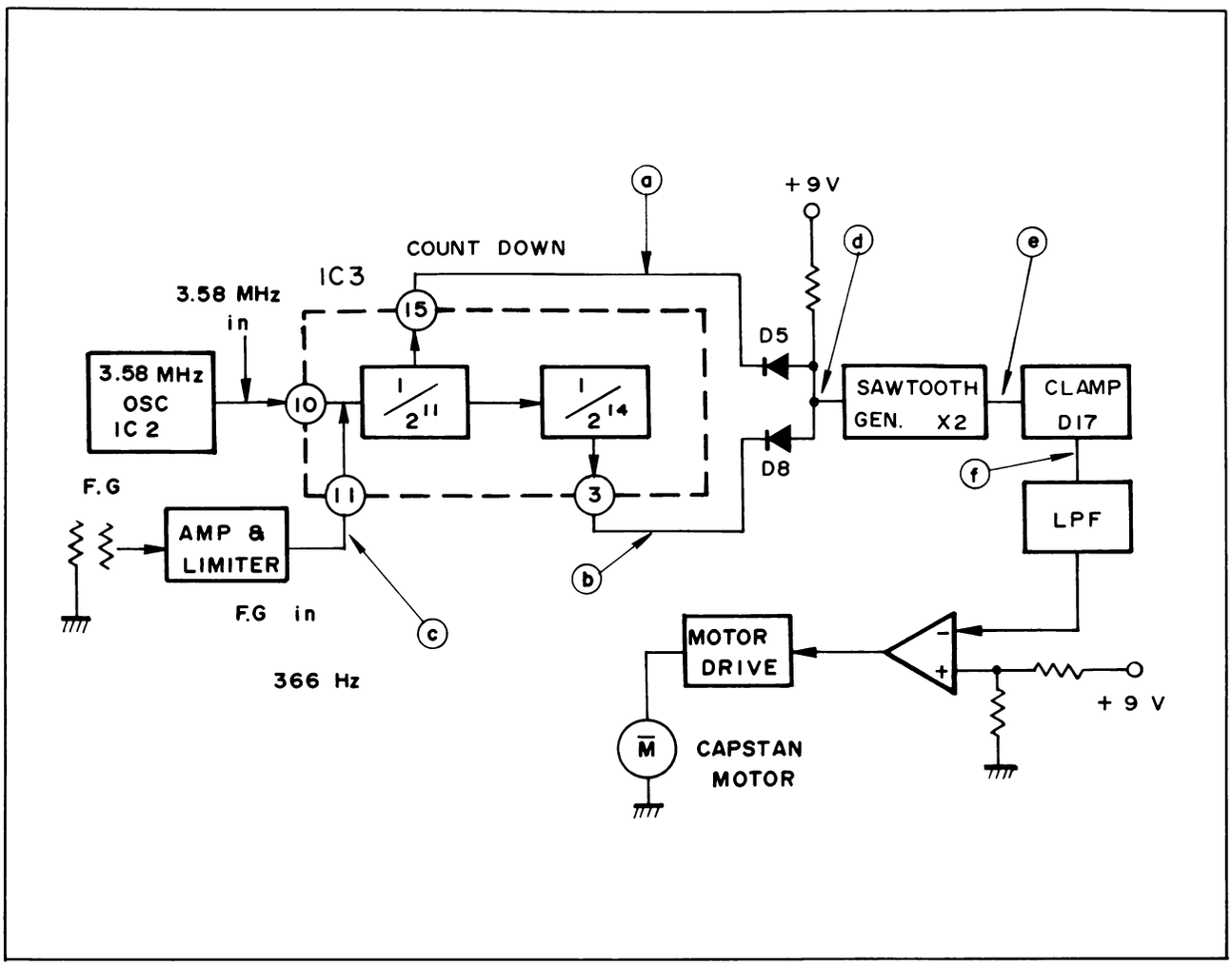



**Fig. 3-37** Capstan servo block diagram

### 3.3.3 Drum servo system

The drum servo system, in Record mode, causes the video heads to rotate at precisely 25.0 Hz, that is, at one-half of the vertical sync frequency. Therefore, the channel-1 (CH-1) video head scans one field and the channel-2 (CH-2) video head scans the succeeding field. In addition, the drum servo system regulates the relative positions of the video heads and tape to keep the vertical blanking period consistently recorded along the bottom portion of the video tracks. Thus, a fixed switching point will appear at the bottom of the TV screen in playback. The pattern of the video tracks, control track and audio tracks recorded under normal conditions is shown in Fig. 3-39 below. All vertical sync signals are recorded in the beginning portion of the video tracks. In the one field-per-track system of the two-head "VHS", frequency modulated video-signals are generally recorded as overlapped (that is, a small portion of the field is recorded by both heads) so that, in play-back, a loss of signal does not occur at switching point.

The switching points are made are made inconspicuous by placing them at the bottom of the TV screen. This drum servo system as well as the capstan servo system is composed of the phase control system and the discriminator control system. For the reference signal of the phase control system is vertical sync signal of input video signal in recording and the control signal recorded on the control track in playback.

On the other hand, the relative signal to control drum rotation is made by phase comparing of the above reference signal and the phase of drum rotation picked up by the drum pick-up head. The discriminator control system functions against large variation to make rotation constant while the phase control system controls video head drum rotation to be constant against smaller variation. The purpose of the playback servo system is to make the rotating heads trace the recorded video tracks accurately. This permits accurate reproduction of the video signals recorded on the tape. Servo control also provides a damping effect to prevent the head from

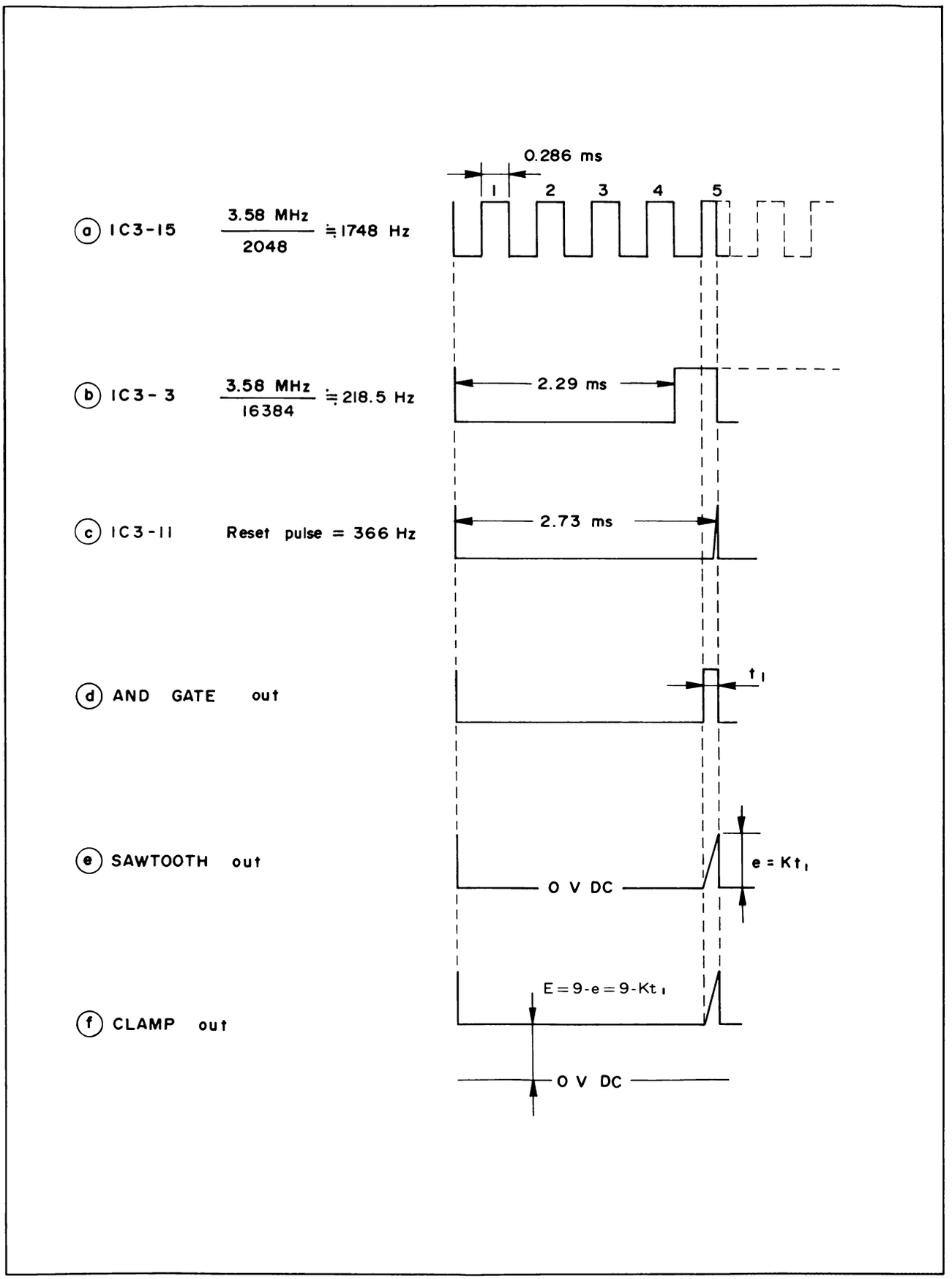



**Fig. 3-38** Capstan servo timing chart

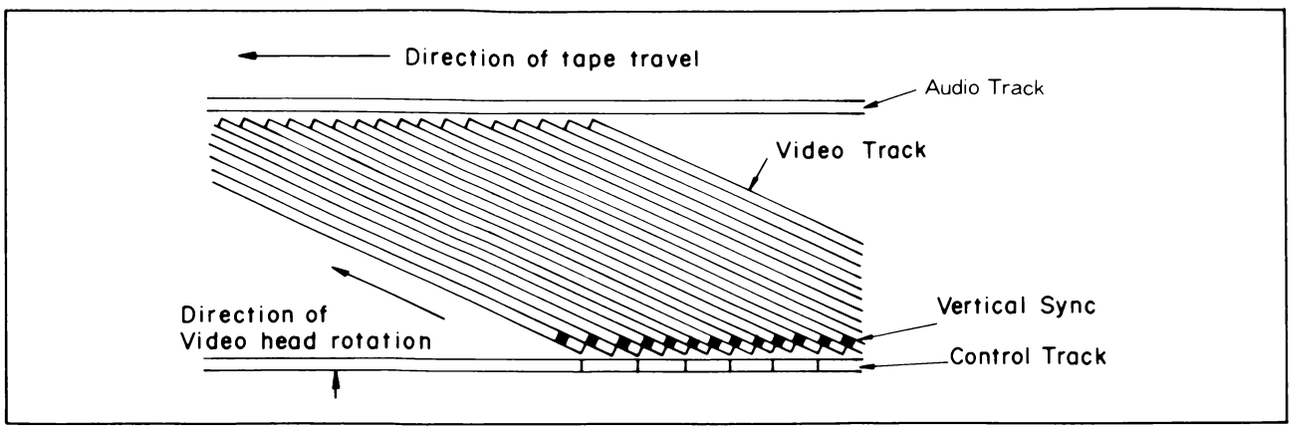



**Fig. 3-39** Video tape pattern

rotating erratically. If erratic rotation of the heads occurs during recording, line-to-line horizontal time-base instability would result. In playback, therefore, jitter would appear in the picture.

**Drum servo system block diagram**

A) Recorded drum servo system

Refer to Fig. 3-62 "Block diagram of drum servo system". The reference signal of the phase control system of the record drum servo system is the input video signal which is supplied from the luminance and color (Y/C) circuit board. This video signal is first amplified by the VIDEO AMPLIFIER [1], then supplied to SYNC SEPARATOR [2], which picks up composite sync signal. This composite sync signal is supplied to the luminance and color (Y/C) circuit board as sync output. And also supplies to low-pass-filter (L.P.F.)[3]. The low-pass-filter and the vertical sync separator (V. SYNC SEP.[4]) rejects the horizontal sync signal from the composite sync signal. Then the 50-Hz vertical sync pulse is sent to a monostable multivibrator (MONO. MULTI.[5]). The monostable multivibrator functions as a 2:1 frequency divider, so that the 25-Hz pulse train supplied to the OUTPUT [6]. Then this signal is supplied to the control head as a control signal.

The other hand, this 25-Hz signal is amplified by the AMPLIFIER [7] and [8] (CONTROL AMPLIFIER), then supplied to the MONOSTABLE MULTIVIBRATOR [9], then supplied to the INVERTER [11] after passing through the OUT [10]. The 25-Hz signal is then supplied to the MONOSTABLE MULTIVIBRATOR [12] (which should be adjusted for the correct switching point during recording). it is then sent to the SAMPLING [14] as the reference signal of the phase control circuit.

On the other hand, the relative signal of the phase control circuit is a train of drum pulses, which is induced by the rotation of the two permanent magnets on the upper drum to a pick-up head. This signal is fed to pair of the monostable multivibrators (MONO. MULTI.[16],[17]) after passing through the AMPLIFIER [15], then supplied to the FLIP-FLOP [18]. The output of the flip-flop, which is a 25-Hz square wave, is supplied to the Luminance and Color (Y/C) circuit board, the V. pulse generator and also supplied to the record inverter (REC INV [19]), then finally supplied to TRAPEZOID [13] (trapezoidal waveform generator). The waveform is then sent to the SAMPLING [14]. This trapezoidal waveform is called the relative signal of the phase control circuit. At the SAMPLING HOLD [14], the relative signal (trapezoidal waveform)is sampled by the reference signal from the MONOSTABLE MULTIVIBRATOR [12], and the sampling error voltage corresponding to the phase difference between two signals is generated. At this sampling error voltage is detected according to the pulse train of the reference signal, so that this sampling error voltage will be held to next sampling then supplied to the NON-LINEAR [20]. Then this signal is supplied to MIX AMP [23] after passing through the Low Pass Filter [21] and Voltage Follower [22].

If large frequency variations caused at starting, etc., cannot be controlled by the phase control circuit alone. If loop gain is increased only by the phase control circuit, a "hunting" phenomenon will occur. To resolve this problem, discrimination control should be done through the damping system.
This is the discriminator servo system.

In detail, 3750-Hz discriminator input generated by the drum's capacitive cog-wheel frequency generator (F.G.), amplified by the Tuning Amplifier (TUNING AMP)[24] and counted-down to half by Flip-Flop [25], and finally formed into a 1875-Hz symmetrical square waveform signal. Monostable Multivibrator (MONO. MULTI)[26] and GATE [27] convert the frequency variations of the signal into voltage variations, the signal is supplied to the Voltage Follower [22] and supplied to Mixer Amp.(MIX AMP)[23], as the discriminator error input.

At the Mixer Amp. (MIX AMP)[23] discriminator and phase control inputs undergo inverting and non-inverting

amplification, respectively. Then after both the control inputs are amplified and mixed by this OP Amp circuit, the combined control output is sent to the AMP [28] of the Motor Drive transistor.

B) Playback drum servo system

The reference signal of the phase control system of the playback drum servo system is the control signal recorded on the control track was picked up by the control head and amplified by the AMPLIFIER [7], [8], then supplied to the monostable multivibrator (MONO. MULTI.[12]) and the SAMPLING [14].

The relative signal of the phase control system is same as the record mode. The only difference is that the phase of the monostable multivibrator and the time constant of the trapezoidal waveform generator are changed.

**Theory of drum servo system**

1. VIDEO AMPLIFIER [1], SYNC SEPARATOR [2], LOW-PASS FILTER [3], VERTICAL SYNC SEPARATOR [4], MONOSTABLE MULTIVIBRATOR [5], OUT [6]

In recording, the video signal whose color element has been eliminated by the low-pass filter composed of C2, C3 and L1 is first supplied to the VIDEO AMPLIFIER [1] to be amplified. After that the signal is supplied to the SYNC SEPARATOR [2], the composite sync signal is stripped from the input video signal of the sync separator. The L.P.F. (low-pass-filter)[3] consisting of R1–R4 and C5–C7, attenuates the horizontal sync comonent of the composite sync signal and supplies it to the VERTICAL SYNC SEPARATOR [4] which sends the 50-Hz vertical sync signal to other points. The 50-Hz vertical sync signal is converted into 25-Hz pulse train by the MONOSTABLE MULTIVIBRATOR [5]. The time constant for this operation is decided by C13 and R5. The signal which passed the monostable multivibrator is supplied in two ways through the OUTPUT [6]; one is supplied to the control head and recorded as the control pulse on a tape, while the other to the AMPLIFIER (IC2) [7]. D1 and D2 are set for eliminating noise especially in playback.

2. AMPLIFIER [7], CONTROL AMPLIFIER [8], MONOSTABLE MULTIVIBRATOR [9], OUTPUT [10], INVERTER [11], MONOSTABLE MULTIVIBRATOR [12]

In recording, the signal from the OUTPUT [6] is supplied to the AMPLIFIER [7], where it is amplified and after that is supplied to the CONTROL SIGNAL AMPLIFIER [8] in the same phase to the input.

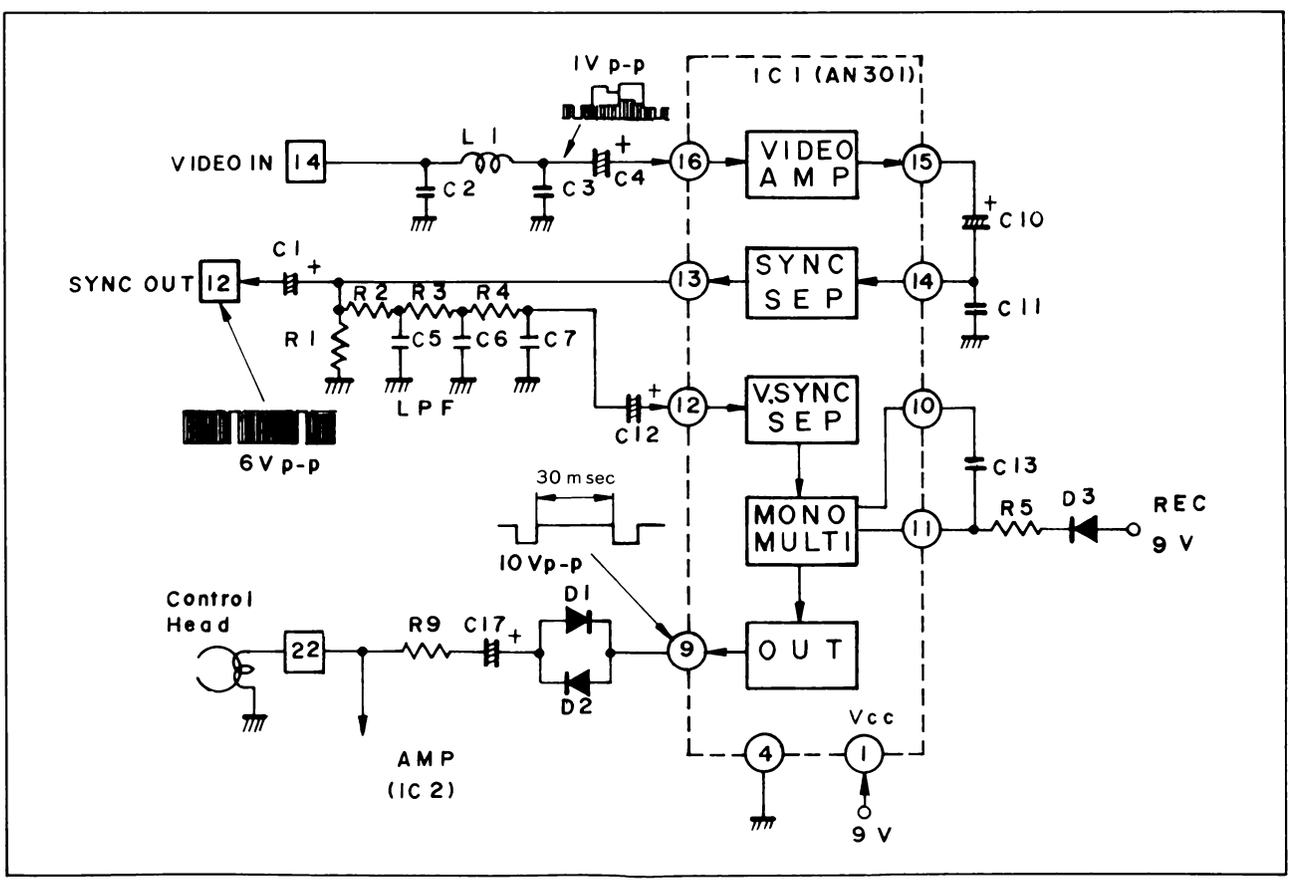



Fig. 3-40 Integrated circuit-1

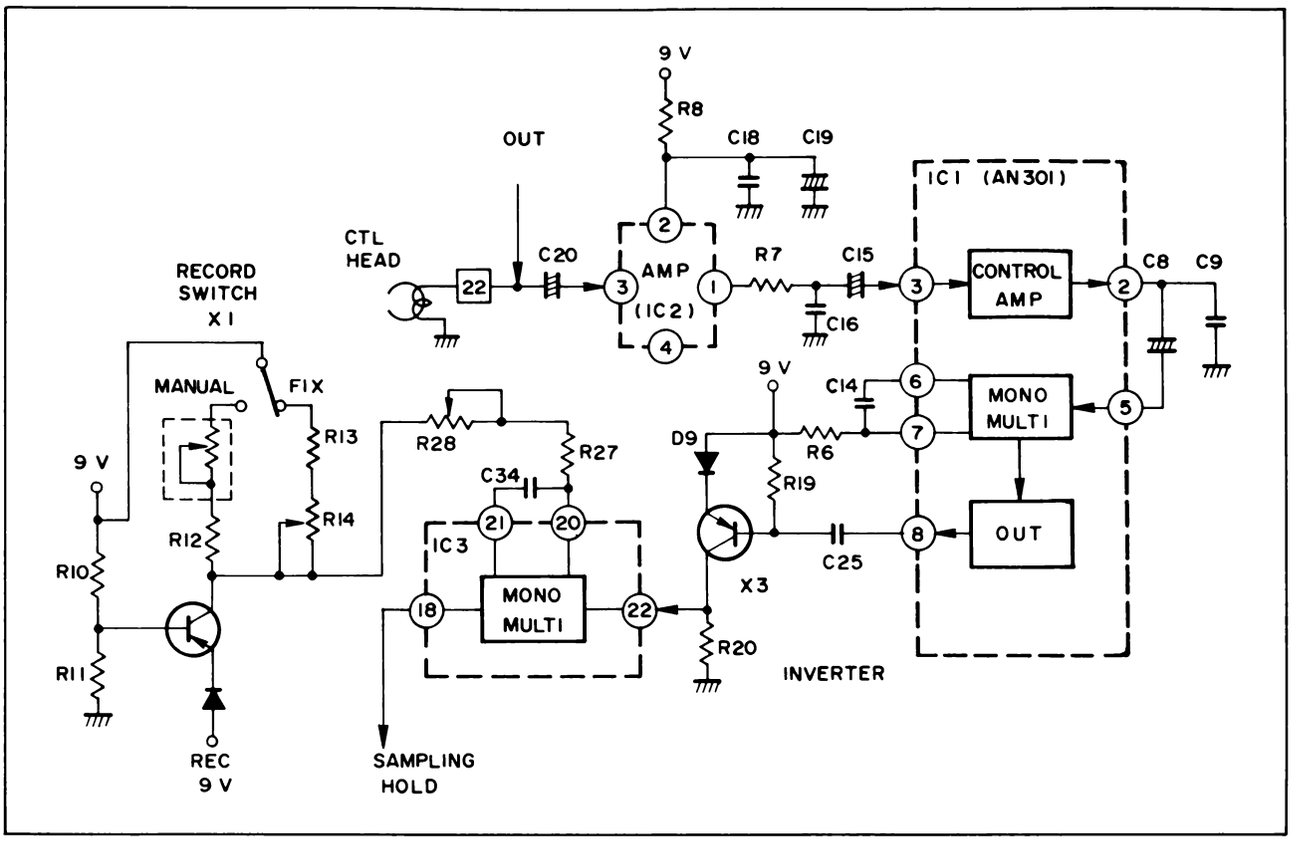



**Fig. 3-41** Record phase monostable multivibrator

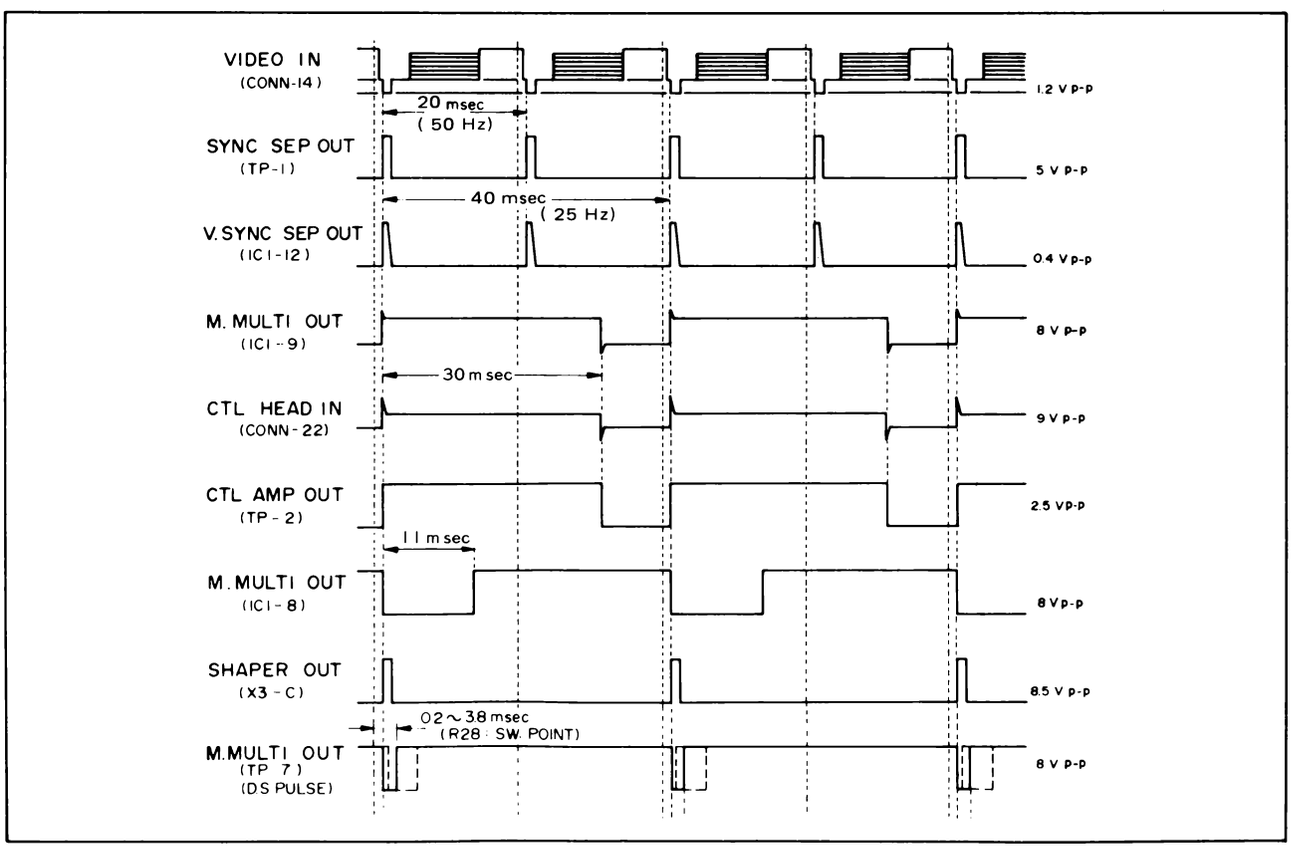



**Fig. 3-42** Reference signal timing chart

The amplified signal is supplied to the MONOSTABLE MULTIVIBRATOR [12] in the same phase as that of the input.

In Recording mode, the SWITCH (recording switch X1) is on and the time constant of the monostable multivibrator is determined by R28, R27 and C34, in other words, the switching point is decided at this stage. Resistor R28 is a variable resistor which adjusts the switching point.

The output of the monostable multivibrator is supplied to the SAMPLING HOLD [14]. This will be the reference signal. In Playback mode, the control signal is supplied from the control head, and this signal takes the same circuit to be the reference signal. In this case the time constant of the MONOSTABLE MULTIVIBRATOR [12] is longer than in recording because of tracking.

### 3. AMPLIFIER [15], MONOSTABLE MULTIVIBRATOR [16],[17], FLIP-FLOP [18]

The drum pulse, source of the relative signal of the phase control system, is picked up in the manner that the drum pick-up head picks up rotation of two magnets inlaid in the drum pulley taking the contrary position each other.

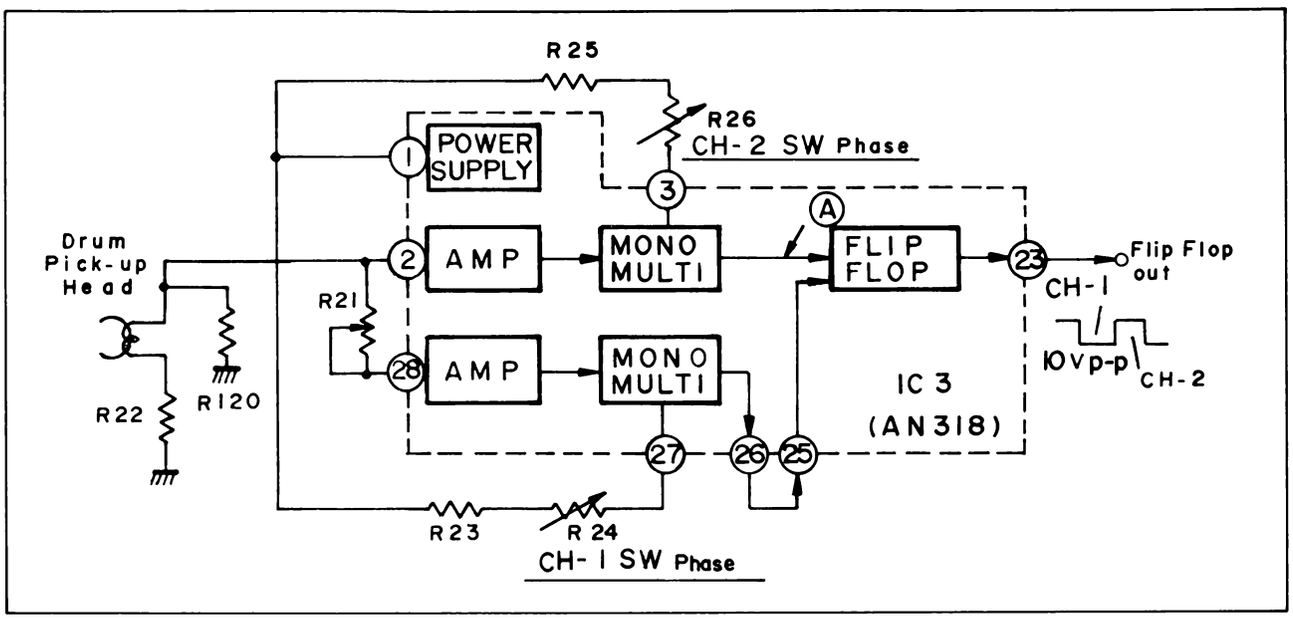



**Fig. 3-43** Relative signal generating circuit

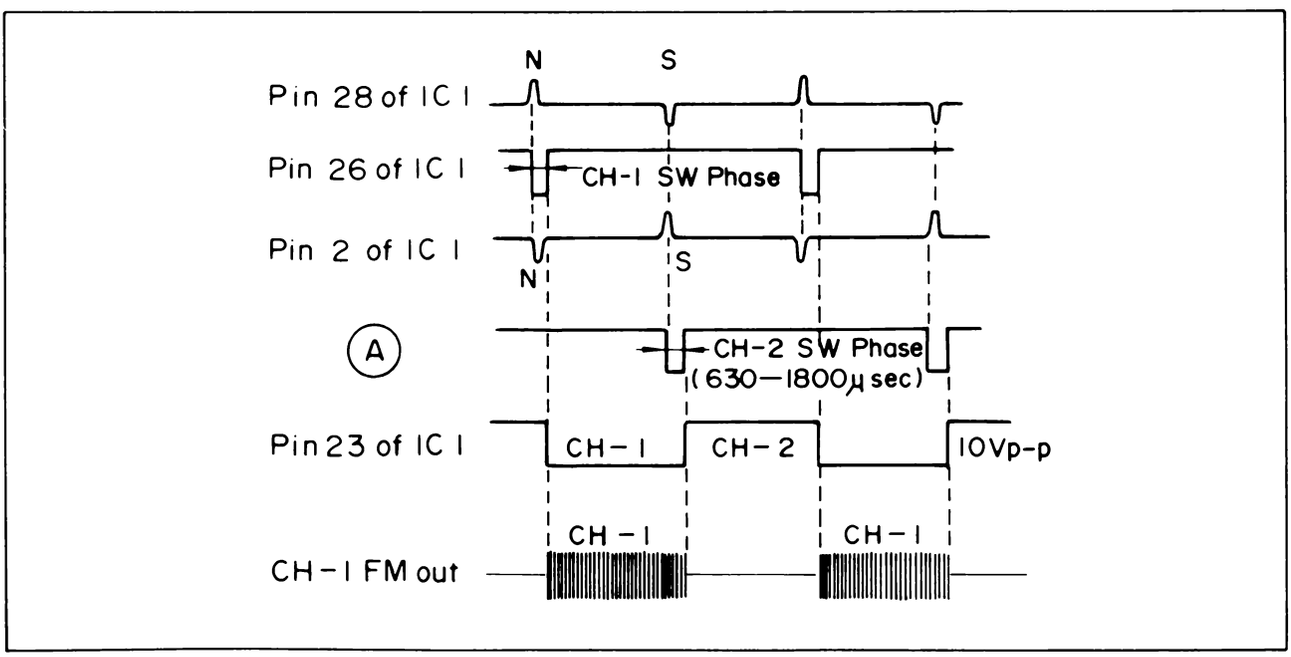



**Fig. 3-44** Timing chart

Flip-flop output signal is generated with the timing shown in the figure.
Flip-flop output is supplied to the luminance and color circuit board and V. pulse generator circuit [30]. The output is supplied to the recording INVERTER [19] and the diode switch.

### 4. RECORD INVERTER [19], DIODE SWITCH

In recording, X2 operates as an inverter since the record 9 V is supplied to the collector of the transistor X2 through D5. (See Fig. 3-45.)
In playback, X2 does not operate while the play 9 V is impressed to D7 and D8 through R18.
In recording, the flip-flop output is reversed by the inverter X2 and in playback, the same phase of the flip-flop output is supplied to the TRAPEZOIDAL WAVEFORM GENERATOR [13].

### 5. TRAPEZOIDAL WAVEFORM GENERATOR [13], SAMPLING HOLD [14]

At the TRAPEZOIDAL WAVEFORM GENERATOR [13] a trapezoidal waveform is generated, which will be supplied to the SAMPLING HOLD [14] as the relative signal. The time constant of the part of the slope of the trapezoidal waveform is determined by C35. In playback, the slope becomes more moderate by impression of the play 9 V coming through R31.
The signal from the output of the monostable multivibrator, namely the reference signal, and it generates sampling error voltage comparing two phases of the relative signal and the reference signal. The generated error voltage is supplied to next NON-LINEAR [20]. C31 is the capacitor to hold the error voltage.

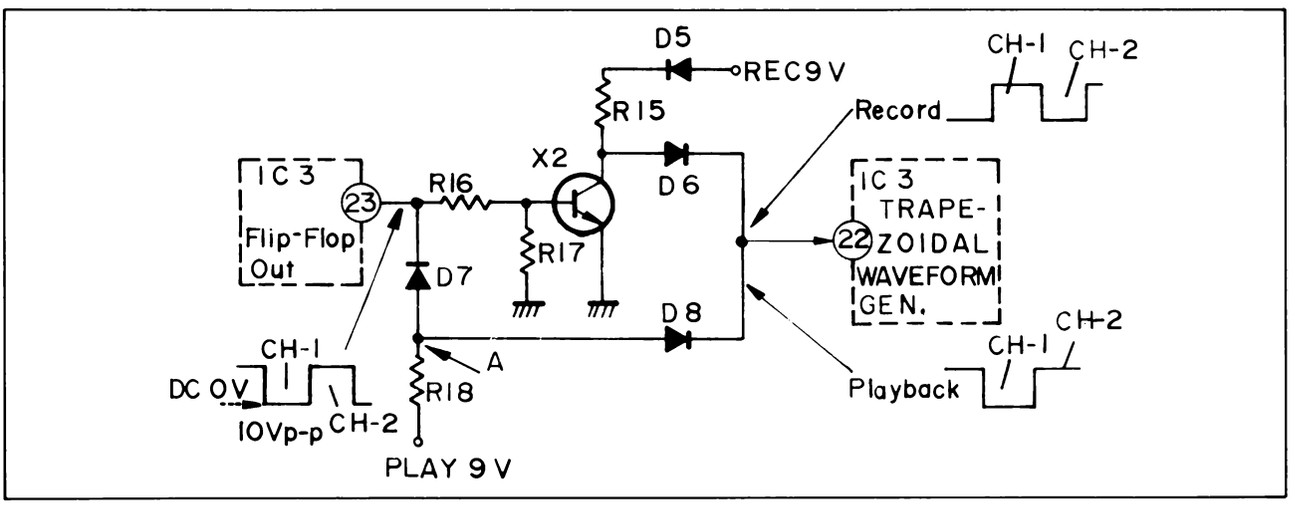



**Fig. 3-45** Record inverter and diode switch

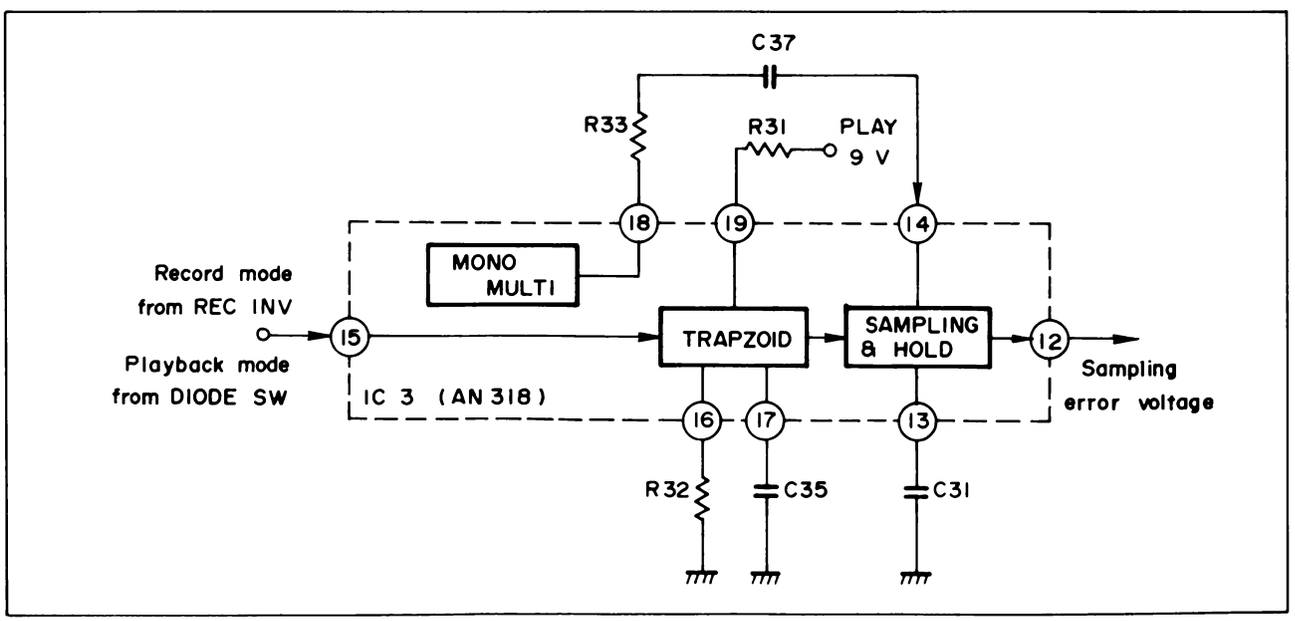



**Fig. 3-46** Phase comparing circuit

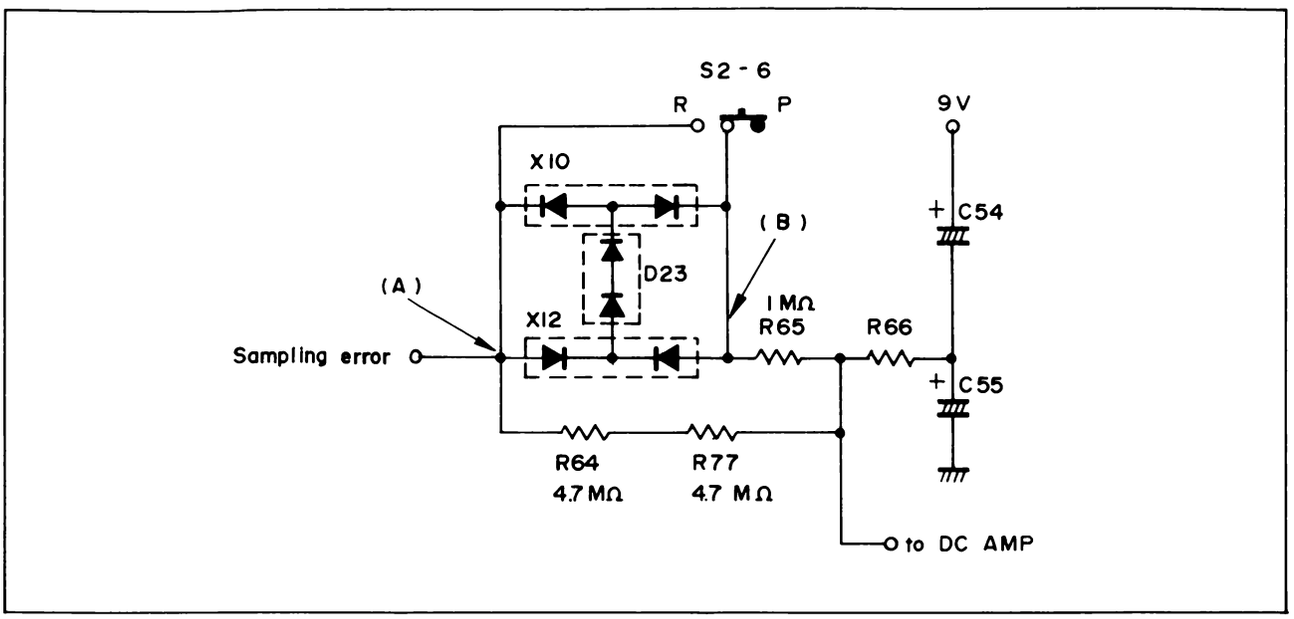



**Fig. 3-47** Non linear and Low pass filter

6. NON LINEAR [20]

In the recording mode, the NON LINEAR [20] does not operate since the switches S2–6 are closed. Resistors R64, R77, R65, R66 and capacitors C55 compose the low-pass filter.

In the playback mode, the switch S2–6 open and the NON LINEAR [20] operates. Since the reference signal to the drum servo is the input video signal in the recording condition, a constant sampling output voltage can be obtained. Accordingly the sampling output in the recording condition is fed to Voltage Follower. But in the playback condition, the reference signal is the regenerated control pulse and therefore contains AC ripple components. When the pulse varies with a rapid AC cycle, then the motor rotates in accordance with the cycle, resulting in playback pictures with much jitter.

In order to prevent this effect, in the Playback mode a non-linear circuit is employed.

The non-linear circuit utilizes the diode characteristic of X10, D23 and X12.

Therefore, when a large voltage difference is due to starting or some other causes, the motor's rotational speed can immediately be followed, and small fluctuations with higher frequency can be eliminated.

C54, connected to the power supply, functions to decrease the response time of the circuit, which is especially necessary to provide rapid lock-in during Playback and Record start-up.

In other words, when the power switch turned ON, the charging time for C55 is necessary a long time. Therefore, C54 is added to speed-up the charging time.

The error voltage which passed through the NON LINEAR [20] is converted by the impedance at Voltage Follower [22], then will be supplied to the MIX amplifier [23]. The signal is finally supplied to the drum motor.

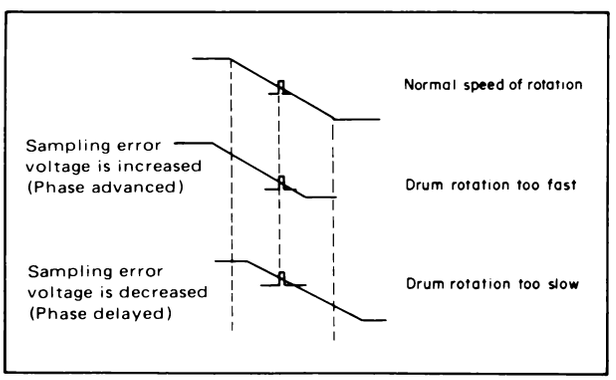



**Fig. 3-48** Phase error of the drum servo system

7. TUNING AMP [24]

Refer to Fig. 3-49.

Timing gear [A] is stationary, while timing gear [B] is affixed to the head drum which rotates at a speed of 25 Hz. Timing gear [A] is loaded with a constant voltage of 3.9 V from R52-R53 and there generates electric charge Q between timing gears [A] and [B]. Electric charge Q is determined by the following fourmula:

$$Q = CV,$$

where C is the capacitance between the timing gears and V is the intially constant voltage (3.9 V). Q is considered constant because of F.E.T. X6 and a bias resistor with very high charging/discharging constant. In operation, electrostatic capacity C between timing gears [A] and

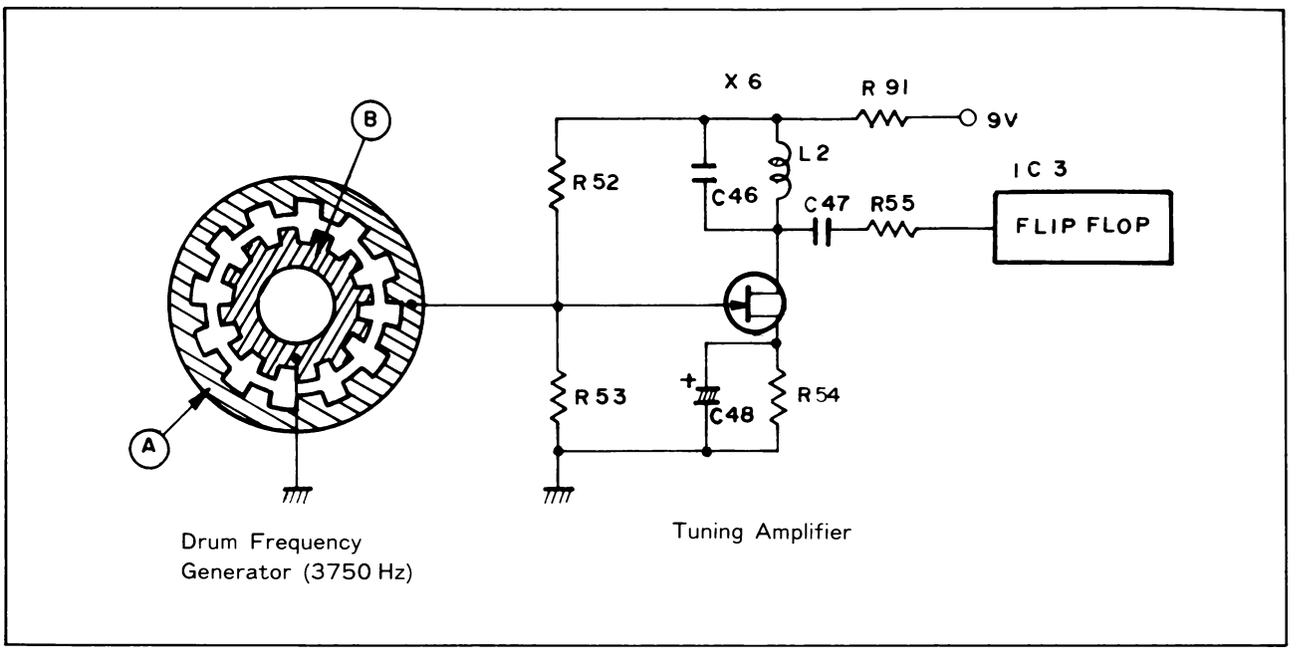



**Fig. 3-49** Drum frequency generator and amplifier

[B] varies due to rotation of the head disk, that is rotation of timing gear [B]. Therefore, V (voltage) will change as C changes, since Q is constant while the head drum is rotating.

The number of cogs of each timing gear is 150 and the head drum rotates 25.0 times a second. Consequently the Frequency Generator (F.G.) generates the following frequency.

25.0 Hz x 150 = 3.75 kHz

This sine wave micro-output of 3750 Hz is amplified by X6. Components C46 and L2 compose a parallel resonance circuit with peak at approximately 3.75 kHz.

The 3750-Hz frequency generator (F.G.) output is the reference frequency of discriminator control circuit.

8. FLIP-FLOP [25], MONO MULTI [26], GATE [27]

In the circuit shown in Fig. 3-50, variations in frequency generated by the F.G. are converted into voltage variations.

The 3750-Hz frequency, generated by F. G. and amplified by TUNING AMP [24], is converted into 1875-Hz (half of the input frequency) by the Flip-Flop and provides the input for the MONO MULTI, and for GATE.

As shown in Fig. 3-51 (c) is determined by the setting of the time constant of (b). Adjustment of R30 sets the pulse width of (b) which is determined by C29, R29 and R30. When input frequency of the F.G. becomes high (the head drum rotates faster), (a) will be shorter and thus, (c) will be longer. This output (c) is finally converted into direct durrent by the low-pass filter composed of R36 and C38.

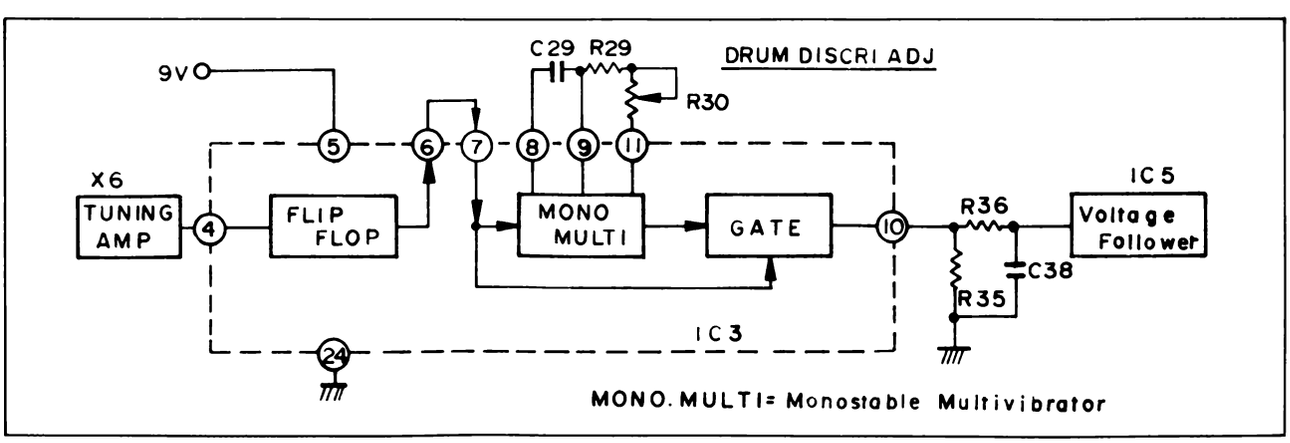



**Fig. 3-50** Discriminator

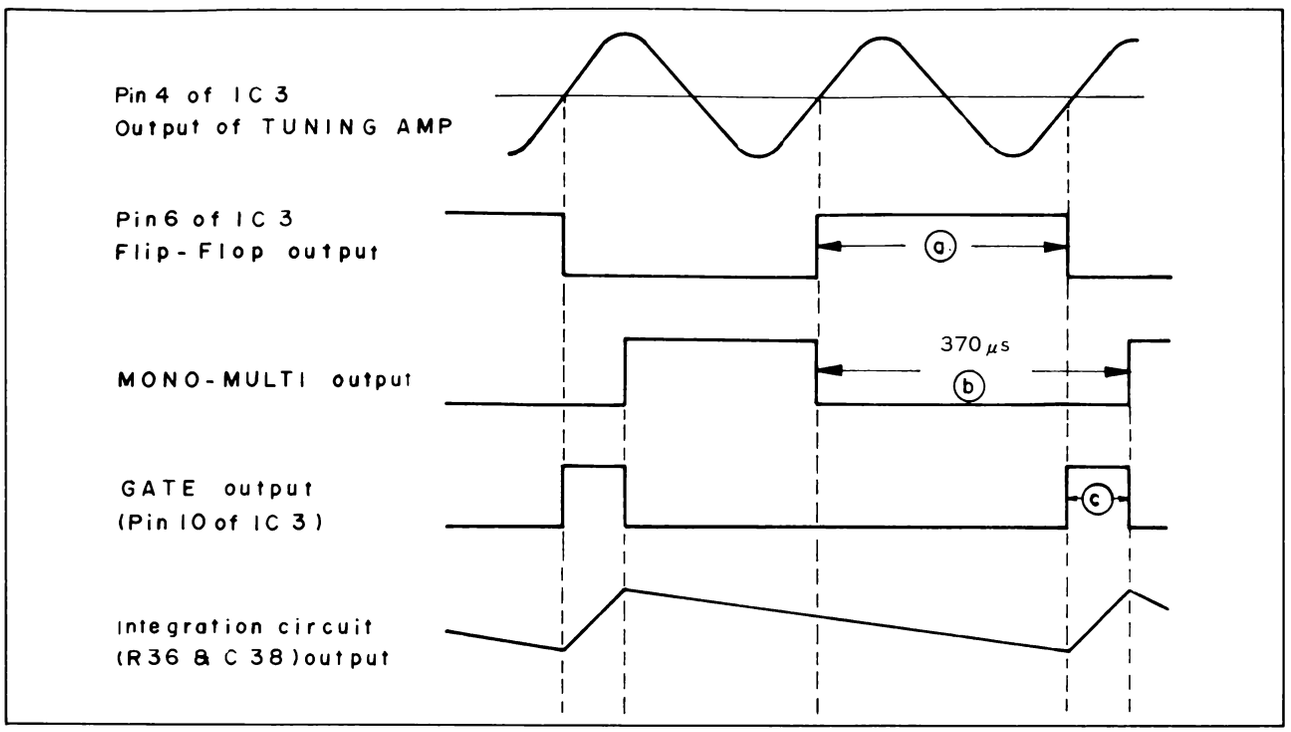



**Fig. 3-51** Timing chart

9. MIX AMP [23]

Refer to Fig. 3-52.
This circuit OPE. AMP circuit [ 23 ] functions in two wave as follow:

1) as non-inverting amplifier for input from V.F. (Voltage Follower – phase control input).
2) as inverting amplifier for input from V.F. (Voltage Follower – discriminator control input)

The output of this circuit is supplied to AMP [28] of Motor Drive Transistor.

10. DRUM ROTATION DETECTOR [31]

In the event drum rotation stops during Record/Play mode (due to overload), this circuit functions to supply stop drive signal to the mechanism control circuit.

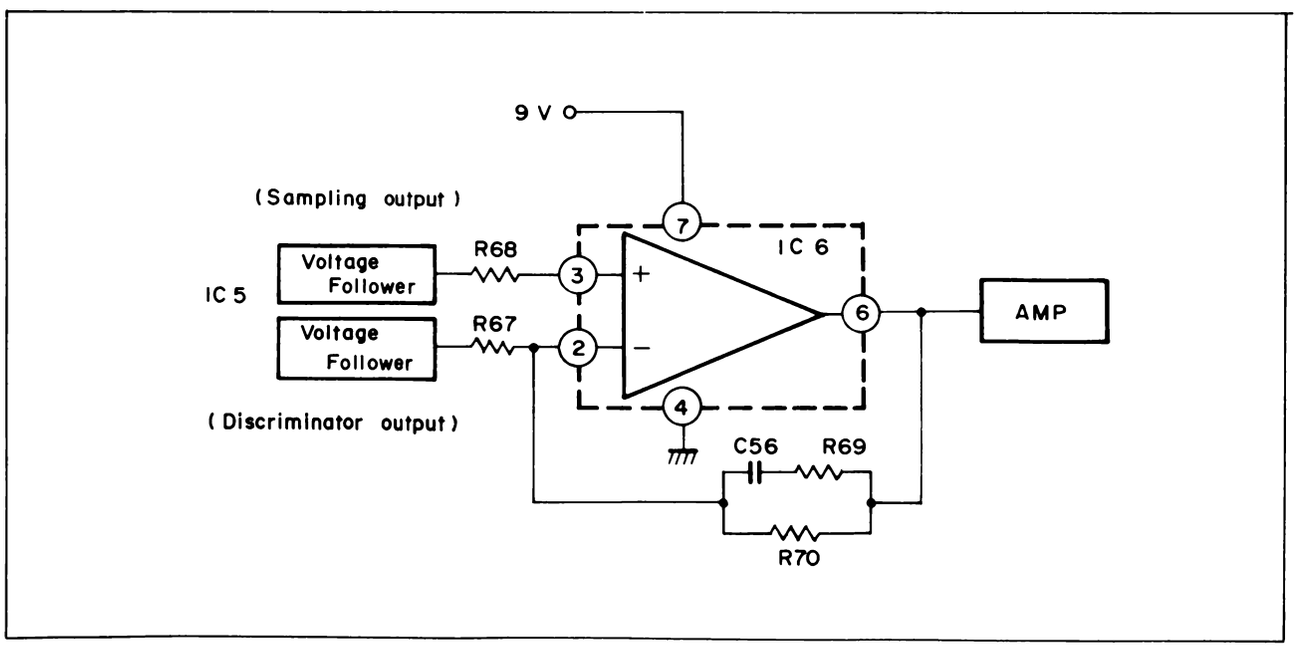



**Fig. 3-52** Mixing amplifier

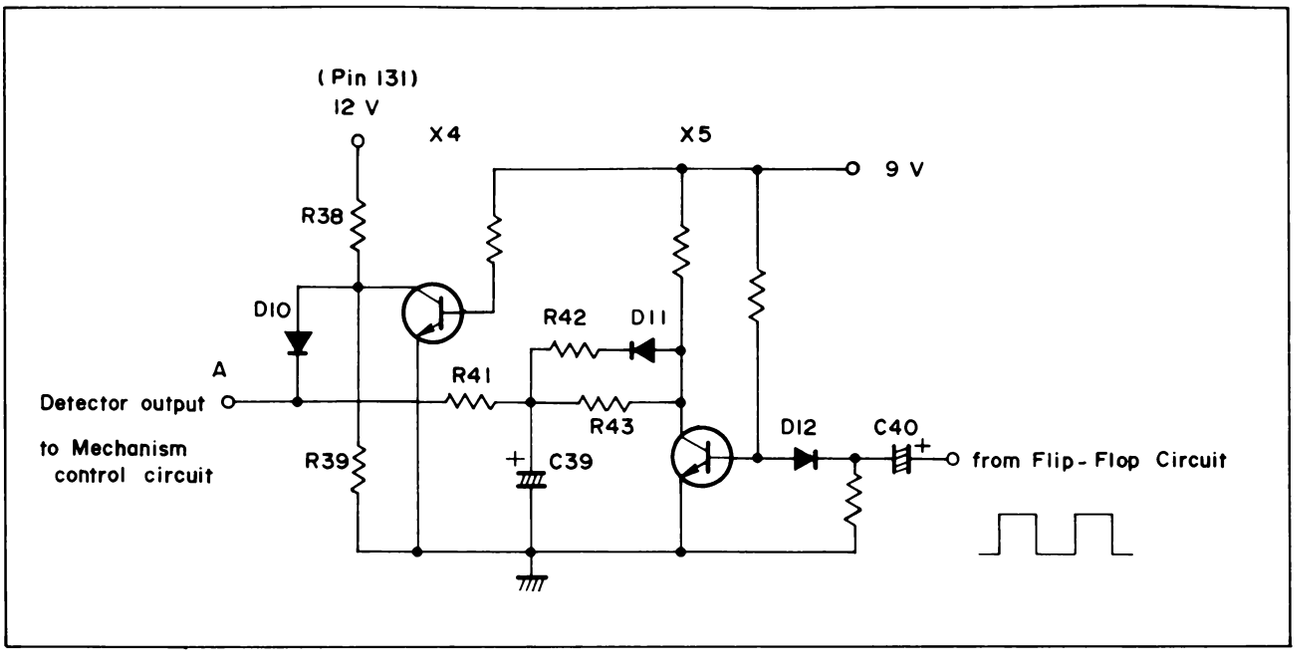



**Fig. 3-53** Drum rotation defector

Both 12 V and 9 V are supplied to the B+ line during Record, Pause, Play and Still modes. When the upper drum rotates in record/play mode, squarewave from flip-flop circuit is supplied through D12 to the base of X5. The squarewave switches X5. When X5 is OFF, C39 becomes charged through D11 and R42; with X5 ON, D11 becomes cut off and C39 is discharged through R43. However, since R43 resistance is high, the next X5 cut off period becomes reached during discharging and again C39 charges. Consequently, in presence of a squarewave input, HIGH voltage becomes supplied to the mechanism control circuit.

When drum rotation stops, the squarewave input ceases, X5 turns on and C39 completely discharges. Detector output becomes LOW in potential. LOW potential is thus supplied to the mechanism control cicuit, the stop circuit is controlled, and the unit stops.

Since the HR-4100E is a portable design, drum motor rotation is stopped during Fast Forward and Rewind modes in order to reduce battery consumption. Squarewave is therefore absent and HIGH is not supplied to point A (see Fig. 3-53) in these modes. Voltage supply to B+ line (9 V power supply) is also absent and X4 is cut-off.

However, with exception of Stop mode, operation switch S1 in 12 volt line (pin 131) supplies voltage in all modes. R38 and R39 divide the 12 V and HIGH voltage becomes supplied to the mechanism control circuit through D10 (since X4 is cut-off). Consequently, Stop mode is not obtained even though the drum does not rotate in FF and REW modes.

11. DRUM FREE-RUN [32]

X8 is cut-off during the period when the CTL (control) signal is not recorded on the tape or when video (sync) signal is absent. X9 turns on and by fixed voltage, the drum rotates at approx. 25 Hz. The purpose of this circuit is to shorten the lock-in time.

During Record/Play mode, a sampling pulse (25 Hz) is normally supplied from monostable multivibrator [12] to C51. This pulse is differentiated by C51 and R57 /R58). The positive pulse of this differentiated waveform switches X8 and D15 on. C52 discharges and until arrival of the next pusle, X8 and D15 are cut-off. Charging then begins due to the time constant of R60 and C52. However, since the time constant is longer than the 25-Hz sampling pulse, the voltage does not reach a level sufficient for switching X9 (the level provided by the next sampling pulse). Consequently, X9 is cut-off.

In Still mode, since the tape is stopped, the CTL signal and consequently, the sampling error voltage are not obtained. X9 turns on at this point and 9 V is divided by R61, R62 and R63. This is then supplied in place of error voltage to the DC amplifier, and the drum rotates at 25 Hz.

Although absence of a sampling pulse during Still mode is normal, noise pulses are easily encountered. Therefore, X7 is included so that X8 does not turn on due to a noise pulse. Forward bias is supplied and X7 turns on only during Still mode. Thus, the interference pulse is absorbed, while X8 becomes reliably cut-off by reverse bias.

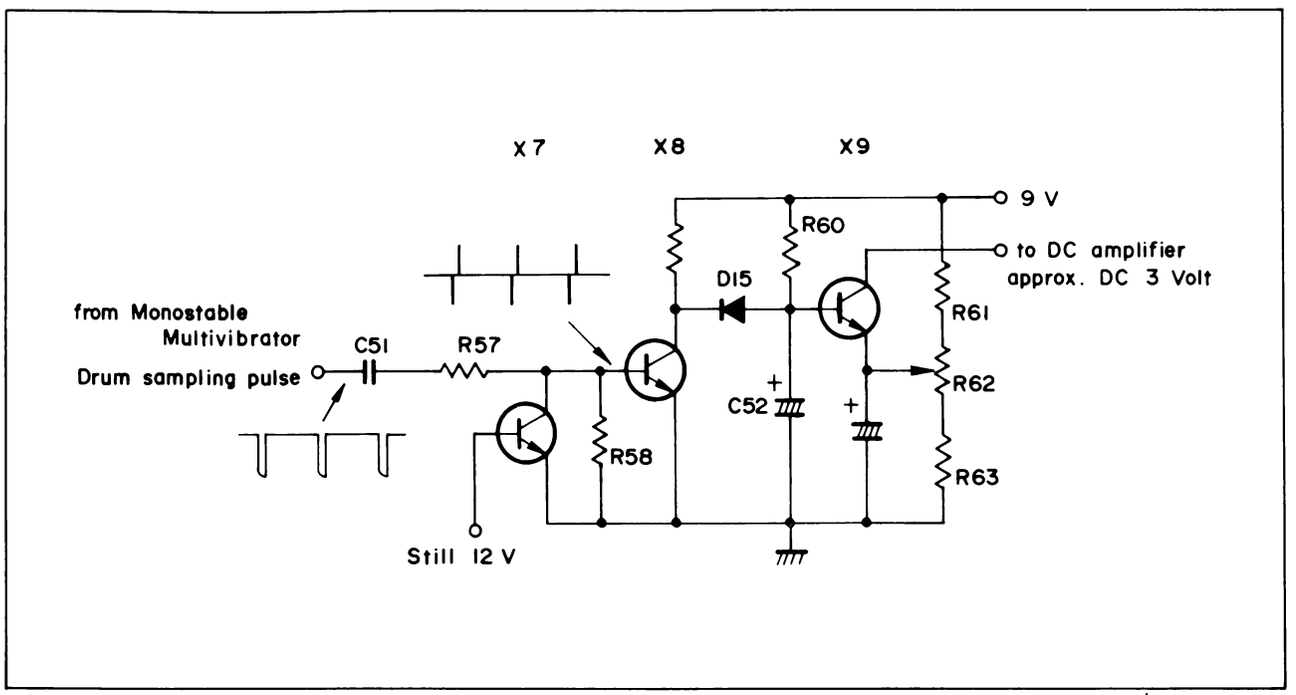



Fig. 3-54 Drum free-run control

## 3.4 AUDIO CIRCUIT

There are three modes, Record, Playback and Audio Dub in the HR-4100E system.
Refer to the block diagram of Fig. 3-55.

### 3.4.1 Recording system

The signal passing through the input select switch is fed to the audio section of the Audio/D. Servo printed circuit board through connector 114. The input signal is attenuated by R75, R76 (E-E LEVEL), then fed to the AGC circuit included in IC7.

However, the signal from the MIC jack is sent to the pre-amplifier in IC 7 through connector 123 and record switch S1-3. The amplified signal is mixed with the line input signal through C66 and R89. The AGC control signal, which is the DC voltage rectified from the output of the line output amplifier included in IC7, is fed to pin 1 of IC7. The AGC output signal is sent to pin 3 of IC7 through record switch S1–7 and the amplified signal is sent from pin 5 of IC7 to pin 6 of IC7 and R99 (REC LEVEL). The signal sent to pin 6 of IC7 is amplified and fed to the audio output Jack and RF unit.

The other signal is fed through D21, C80, R103–R104,and R107–R108 to the AGC circuit. On the other hand, the signal passing through R99 is amplified at the record amplifier in IC7 and fed to the audio head through the connector 153, and thus is recorded on the tape.

During recording, a signal of approximately 70-kHz, from T1 through R119 (BIAS LEVEL) and C89, is used as the AC bias. Transistor X17 controls the oscillation of the bias oscillator. Transistor X18 and X19 comprise a bias oscillator of the push-pull type. The output of the secondary of T1 is applied to the full erase head, the audio erase head and through R119, to the audio head.

### 3.4.2 Playback system

The playback signal passing through connector 151 is fed to the preamplifier, pin 16 of IC7, through the switch S1–3. Since the amplitude of the playback signal is propotional to the rate of change of the magnetic field recorded on the tape, the playback signal is smaller at lower frequencies. To compensate for this, characteristic equalization is performed in the preamplifier. The response of the equalizer is determined by R87, R88 and C63. The amplified signal is fed to pin 3 of IC7, amplifier, through R90 (P.B. LEVEL) and the switch S1–7. The output signal is fed from pin 5 of IC7 to pin 6 of IC7, output amplifier. The amplified signal is fed to the audio output jack and RF unit. Transistor X16 and diodes D18–D19 comprise a squelch circuit which reverse-biases pin 6 of IC7. The line output amplifier does not operate till the tape is loaded completely, and in the Still mode.

### 3.4.3 Audio dub

In the Audio Dub mode, the video signal is in Playback and the audio circuit is in the Recording mode except the full erase head. The full erase signal from the secondary of T1 is desconnected from the full erase head by the switch S2–2.

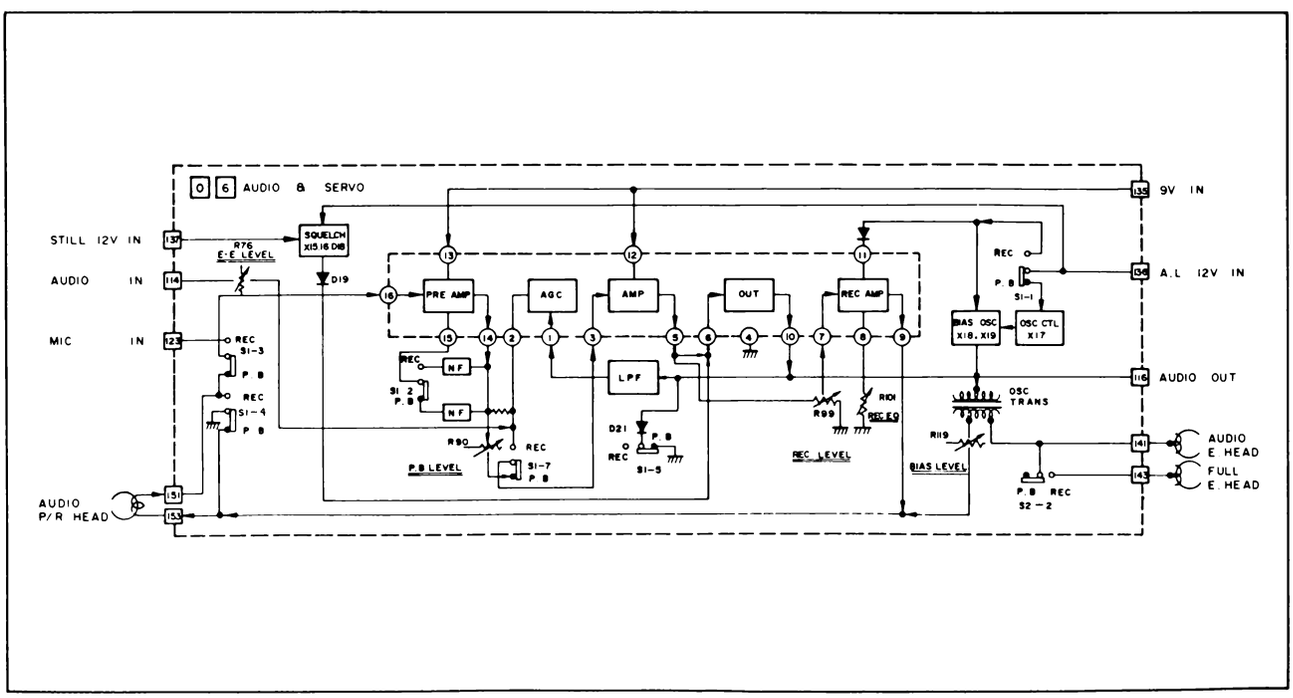



Fig. 3-55 Block diagram of audio circuit

## 3.5 REGULATOR CIRCUIT

Transistors X6 & X7 form an astable multivibrator which oscillates at approx. 23 kHz. This output is supplied, via drive transistors X8 & X9, to large current-switching transistors X10 & X11. The resulting square wave output is rectified by diodes D18 and D19 to become approx. 20 VDC.

A comparison voltage is applied to the 9 V regulator, IC6, pin 4. Pin 6 voltage is the reference voltage and the error voltage is obtained from pin 10.

By employing an adequate reference voltage from rectified 20 V for power transistor control, stable regulator output can be obtained even with a reduction of input voltage.

### 3.5.1 DEW/EMPTY and WARNING indicator

Two lamps (LEDS) are employed to indicate the degreee of battery consumption. The yellow LED lights when voltage from the battery input circuit declines to 11 V, while the red LED lights when this reaches 10.8 V to advise that the battery should be replaced. This LED also flashes in event of moisture condensation.

IC7 is composed of two operational amplifiers. One of the two op-amp inputs is obtained from regulator as the reference voltage. This is compared with the decline of DC voltage applied to circuit and the resulting difference is obtained as an output. LED drive transistor X12 turns on and LED lights.

The remaining 1/2-IC7 and X13 function in the same manner to light the LED.

### 3.5.2 Dew (moisture) sensor and power supply delay

A. Moisture Sensor

Moisture condensation on tape transport path can impair tape trnasport, damage tape and, if severe, even damage the machine. This circuit is threfore included to detect condensation and cut-off 9 VDC regulator out. DEW/EMPTY lamp (red LED) then flickers as an alarm.

Resistance of the dew sensor element is several kΩ at 75% humidity and increases with higher humidity. This element is mounted on the drum, while electronic switches X1 and X2 are contained on the head printed circuit board. Schmitt trigger 1/2-IC4, oscillator 1/2-IC4 and electronic switch X4 are located on the CAP/REG board.

If moisture is not detected 0.5 s after pressing the operation key, IC4 pin 13 becomes LOW in potential (approx. 3.5 V) and IC4 pin 10 LOW potential. X4 is thus cut-off at the point the regulator output is switched and X5 becomes cut-off at the point the capstan drive input is switched. Oscillator output IC4 pin 4, which controls DEW/EMPTY lamp (red LED), is LOW. This is a normal condition.

In the event the dew sensor detects condensation 0.5 sec after an operation key is pressed, IC4, pin 13 becomes HIGH and IC4, pin 10 shanges to HIGH potential. This output controls IC6, and 9 VDC becomes supplied to X4 at the cut-off point. Voltage is also supplied to X5 and the capstan motor stops.

IC4 pin 10 output causes 1/2-IC4 to oscillate (oscillator is composed of 1/2-IC4, R29, R30, C15 and C16); IC4 pin 4 output switches X13 ON-OFF and lamp flickers.

B. Power Supply Delay

As this unit is not provided with an external power switch, operation becomes simultaneous with supply of power. The 9V regulated output is delayed approx. 0.5s until the mechanism control circuit stabilizes. If this circuit does circuit does not operate, the stop solenoid would function at supply of power and function hold may not operate.

Charging time constant is maintained by R22 and C14 in transistor X3 base circuit. X3 is cut-off during charging time. As a result, via above-mentioned dew sensor circuit, regulated 9 V appears 0.5 s later.

## 3.6 MECHANISM CONTROL CIRCUIT

### 3.6.1 Functions of the mechanism control circuit

A. These circuits control the sequencing of the tape Loading circuits. They insure that each motor, solenoid, light, etc. energizes or de-energizes at precisely the correct moment.

B. A secondary function is to control the tape in such a manner as to minimize the possibility of tape damage or mechanical malfunction.

C. It also provides simplified control which eliminates the possibility of user error and provides easy re-moting.

### 3.6.2 Theory of circuits

Before we begin the theory of operation the individual blocks we should agree on a few definitions. The descriptions below are not all inclusive but will identify most of the logic circuits used in the mechanism control cirduits.

A. AND circuit (Fig. 3-56)

Definition: If and only if all the inputs, 'A', 'B' and 'C' are high, the output, 'X' is high. However, if any one of the inputs is low, the output is low.

B. NOT circuit (Fig. 3-57)

Definition: When the input 'A' is high, the output 'X' is low and when the input 'A' is low the output 'X' is high. That is, the state of the input is reversed in the output.

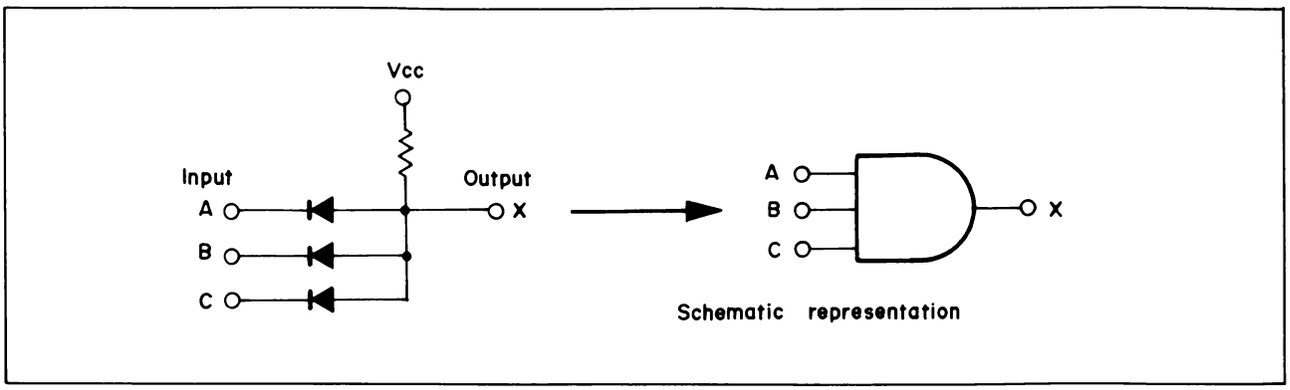



Fig. 3-56 AND circuit

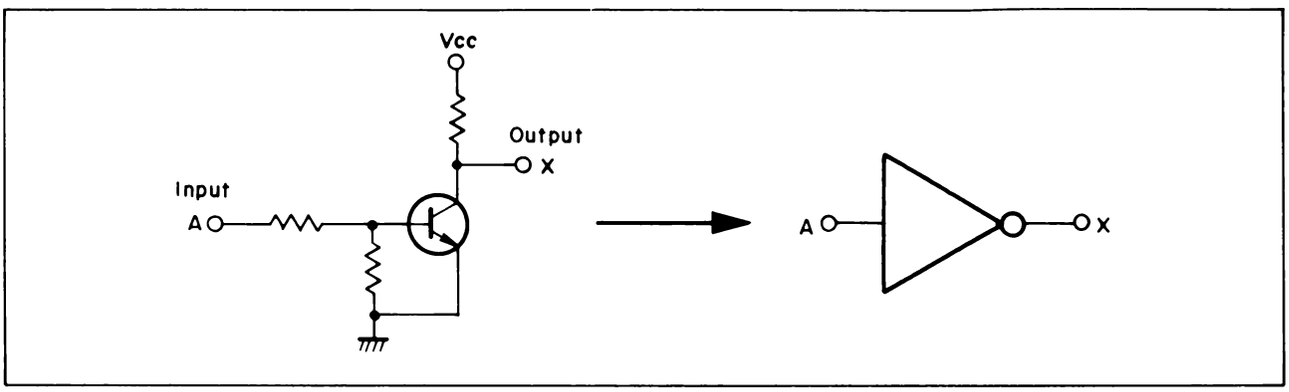



Fig. 3-57 NOT circuit

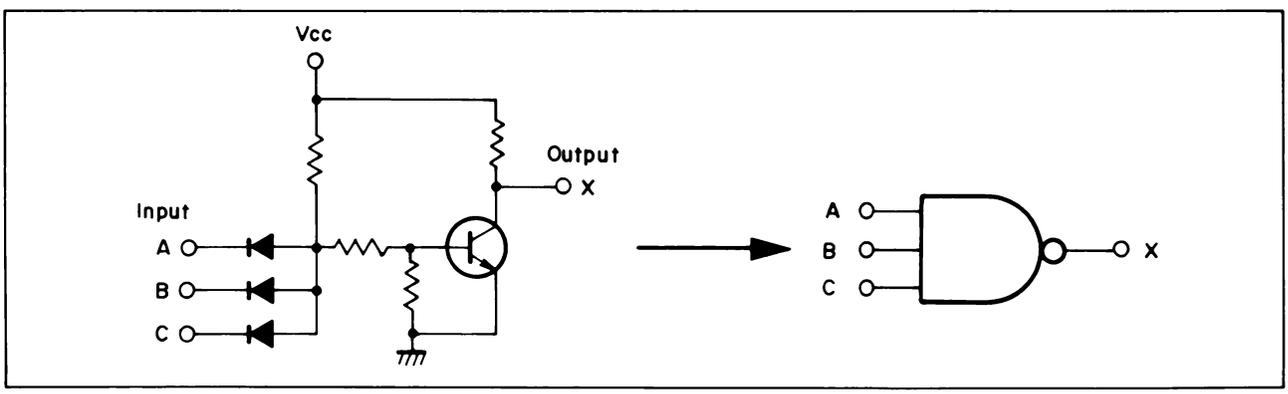



Fig. 3-58 NAND circuit

C. NAND circuit (Fig. 3-58)

Definition: The NAND circuit combines AND logic with NOT logic. Its output is low when all the inputs are high. If any one input is low, the output is high.

This circuit is principal function for the automatic stop and the pinch roller solenoid control.

D. Automatic stop

Automatic stop circuit place the "VHS" is the Stop mode for any one of the following reasons.

1. When the dew sensor detects moisture on the drum. . . . . DEW SENSOR
2. For 0.5 second after operating the function keys. . . . . REGULATOR DELAY
3. When the filament of the lamp opens. . . . . CASSETTE LAMP
4. When the tape will interrupt the tape guard. . . . . TAPE GUARD
5. When the drum rotation stopped in Record or Play mode. . . . DRUM ROTATION DETECTOR
6. When the end of tape is reached in Play, Record or F.F. mode. . . . . END SENSOR

**Table 3-1** "VHS" mode and mechanical parts

| Mode / Mechanical Parts | F.F. | PLAY | | | REC | | STOP | | REW |
|---|---|---|---|---|---|---|---|---|---|
| | | During loading | After loading | Still | Record | Pause | During unloading | Stop | |
| Drum Motor | X | O | O | O | O | O | O | X | X |
| Capstan Motor | O | O | O | X | O | O | O | X | O |
| Pinch Roller Solenoid | O | O | O | O | O | X | O | X | O |
| Stop Solenoid | X | X | X | X | X | X | X | *O | X |

**Note:** O ..... ON, X ..... OFF
* When any one of sensor operates.

**Table 3-2** Number, name and operation of microswitch

| Microswitch No. | Name | Time when activated | Function |
|---|---|---|---|
| S1 | Operation switch | FF, PLAY, REW key depressed | 12 V DC is supplied to S12 in Loading, PLAY, FF, REW. |
| S2 | Play switch | PLAY key depressed | Activates respective control circuit. |
| S3 | Rewind switch | REW key depressed | |
| S4 | Record switch | REC key depressed | |
| S5 | Pause/Still switch | PAUSE key depressed | |
| S6 | After loading switch | Pinch roller slide plate pulled | 12 V DC is supplied to circuit at loading arm released. |
| S7 | Unloading-1 switch | Pinch roller slide plate returned | 12 V DC is supplied to S12 during unloading. |
| S8 | Unloading-2 switch | Closed with S7 | Should supply regulated 9 V to circuit. |
| S11 | Pinch roller solenoid switch | Pinch roller solenoid energized | Prevent over-heating of solenoid. |
| S12 | Cassette switch | Cassette housing lowered | 12 V supplied to all circuit. |
| S16 | Power switch | Unloading idler off lever moved | 12 V DC supplied to S12. |

7. When the transparent leader tape at beginning of the tape is reached in Rewind.. START SENSOR
8. When the counter reading approaches "999" in Rewind with SEARCH button in the ON position. . . . . COUNTER STOP
9. When the unit is operated for approximately 7 minutes or more in Pause/Still mode. . . . . PAUSE TIMER
10. When no cassette housing is lowered. . . . . CASSETTE SWITCH

1. DEW SENSOR CIRCUIT

   Refer to Section 3.5.2, A.

2. REGULATOR DELAY CIRCUIT

   Refer to Section 3.5.2, B.

3. CASSETTE LAMP

   The lamp is usually light for both the end and start sensors. Also forward bias is supplied to X1 through the lamp.
   As a result, X1 is conducting and the collector is low in potential.

When the filament of the lamp is open, X1 is cut-off and collector of X1 becomes to high voltage which supplied to pin 6 and pin 8 of IC1.

A following circuit functions in the same manner as the end and start sensors.

4. TAPE GUARD

If a tape transport malfunction spills tape, the tape will interrupt the tape guard light beam which causes the resistance of the photo transistor to go to 20 MΩ or more. This causes pin 11 of IC2 to go to low potential.
As a result, the output of IC2 NAND GATE becomes high in potential.

5. DRUM ROTATION DETECTOR

Refer to Section 3.3.3, Item 12.

6. END SENSOR

The resistance of the photo transistor is 1–2 kΩ under light, and 20 MΩ or higher when dark. When the transition is made from video tape (opaque) to leader tape (transparent), light strikes the photo transistor lowering its resistance. As a result, the high voltage is supplied to pin 8 of IC1 through the photo transistor. Pin 9 of IC1 is usually high potential except Rewind mode.
Therefore, output pin 10 of IC1 is switched to low potential when photo transistor received light beam. The output signal is supplied to pin 13 of IC2 through D6 which composed the AND GATE by R19, D4–D6.

7. START SENSOR

The start sensor functions in the same manner as the end sensor.

8. COUNTER SEARCH

During Rewind, a positive voltage is applied to pin 2 of IC1 from the rewind switch. When the counter rotates from 000 to 999, a positive pulse is applied to pin 1 of IC1 from the search switch through C1. Pin 3 of NAND GATE becomes low.

9. PAUSE TIMER

This is pause timer circuit to prevent over consumption for the battery, video heads and tape. When the PAUSE key is depressed in Record mode, the pinch roller solenoid is de-energized. In other

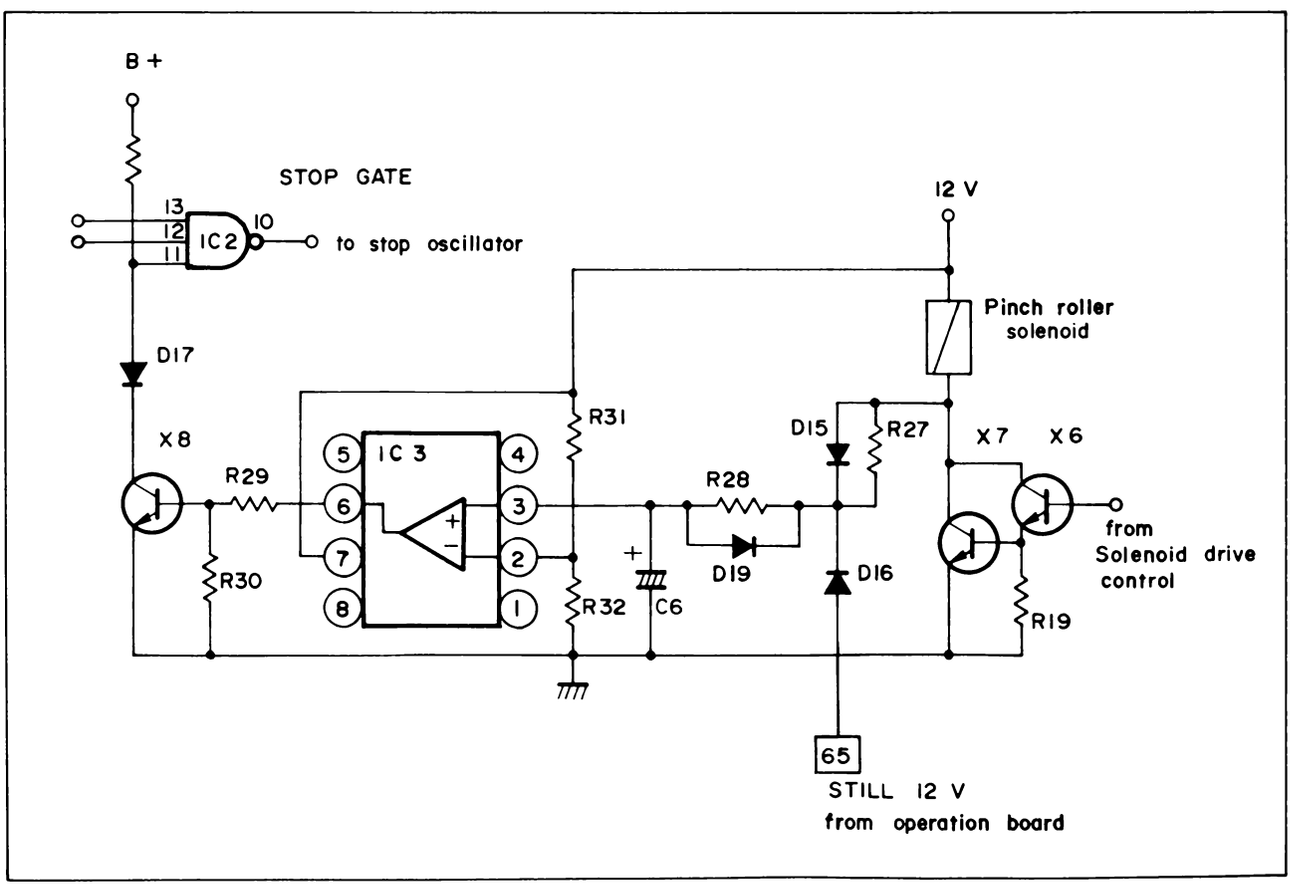



**Fig. 3-59** Pause timer

words, X6 and X7 are cut-off and the collector of X7 becomes to high voltage.
As a result, 12 volts through the solenoid is applied to pin 8 of IC3 across D15, R28 and C6. Pin 6 of IC3 goes to high potential approximately seven minutes after which determined by the time constant of R28 and C6. As a result, X8 is "on", pin 11 of IC2 is "low", then finally the unit will be returned to Stop mode.

On the other hand, when the PAUSE key is depressed in the Play mode, after passing through the S4 (REW switch) 12 V is applied to C6, across D16 and R26. Therefore, the unit returns to Stop mode approximately seven minutes after.

10. OSCILLATOR

This is composed of 2/3-IC2, R13, R15, C3 and C4. In normal operation, i.e.: stop NAND gate 1/3-IC2 pin 10 at LOW potential, IC2 pin 9 is HIGH and pin 6 LOW.
Pin 9 voltage charges C3 and C4 through R15. This potential goes through R13 to pin 8, while HIGH voltage from operation switch S1 is applied to pin 1.

When the stop sensor operates, pin 10 of IC2 (stop gate) becomes HIGH. As a result, pin 9 becomes LOW and pin 6 HIGH. Forward bias is then supplied to X2.

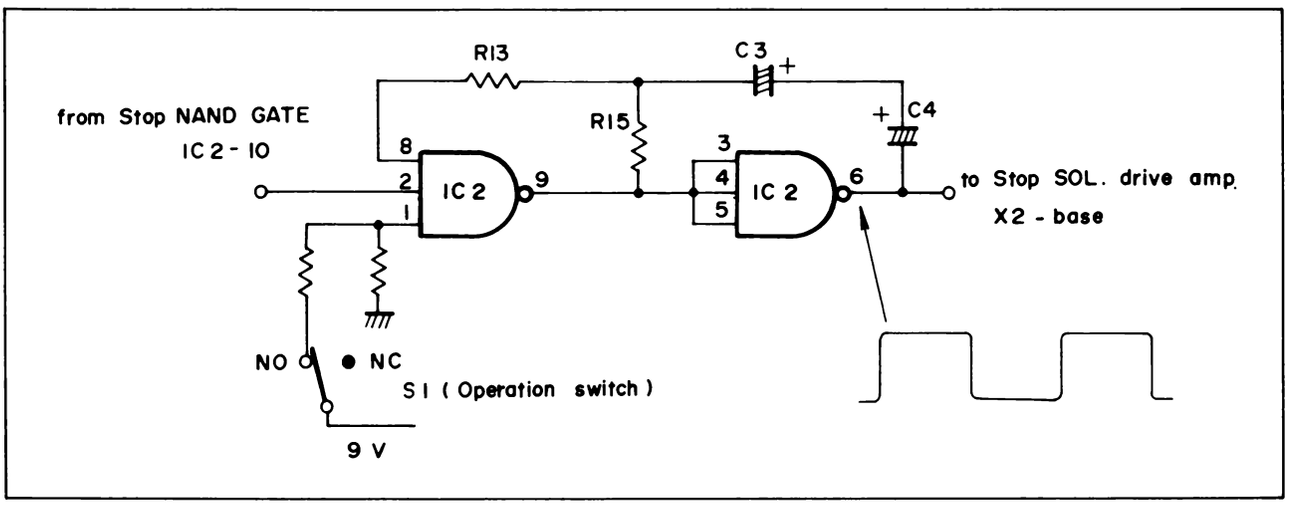



Fig. 3-60 Oscillator

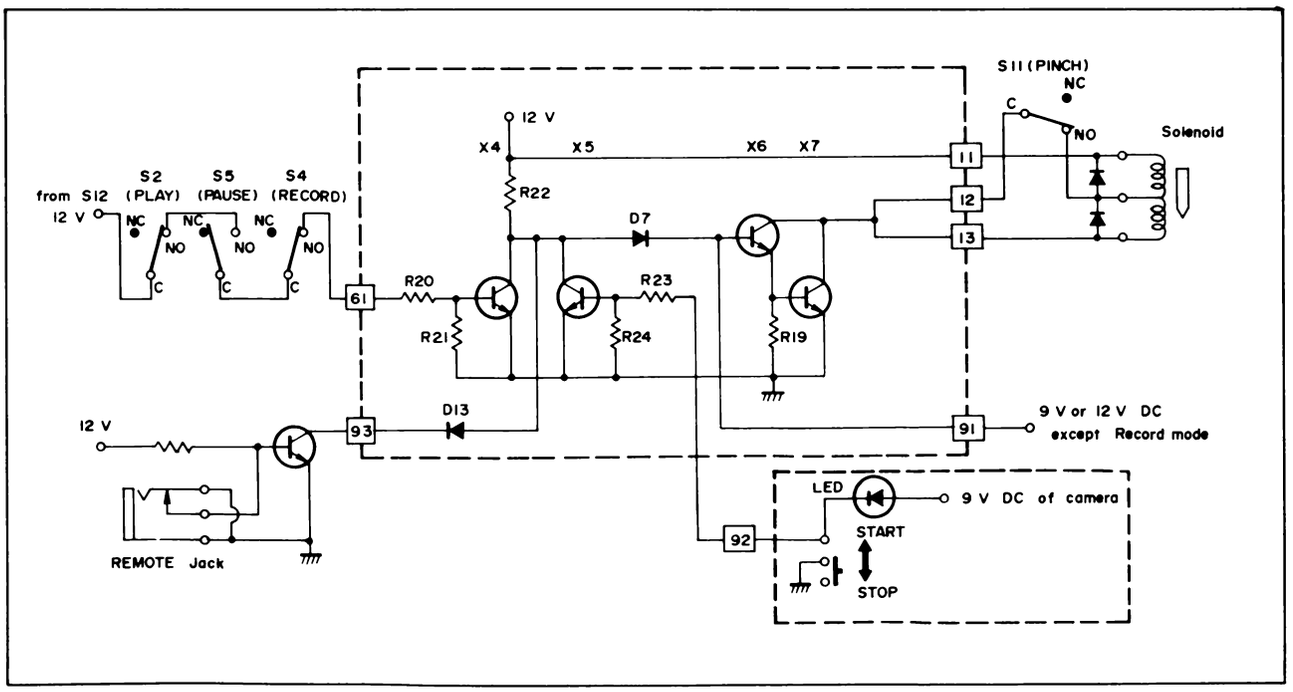



Fig. 3-61 Pinch roller solenoid control

C3 discharges through R15. Consequently, pin 8 potential declines and pin 9 again becomes HIGH. This HIGH potential again charges C3 and pin 8 becomes HIGH. This operation continues so long as pin 1 or pin 2 does not become LOW.

B. PINCH ROLLER SOLENOID CONTROL

Simultaneously with the turning on of X6 and X7, the pinch roller solenoid is energized. By the operation of the solenoid, the unit is set to the prescribed condition.

The terms that X6 turns on are the following:
1. X4 is cut-off.
2. X5 is cut-off.
3. D13 is cut-off.

If any one of terms is not satisfyingly, X6 is cut-off in Record mode.

When the PAUSE key depressed in Record mode, 12 volts DC is applied to pin 61 by the S5 (PAUSE/STILL) switch through the S4 (RECORD) switch. When the START/STOP switch of GC-4100E is set to STOP position in Record mode, the voltage of pin 92 is approximately 4 volts. When the Pause remote control switch is set to ON position in Record mode, the voltage of pin 93 is approximately zero volt.

The high voltage is applied pin 91 in Loading, Play, Unloading, Fast Forward, Rewind mode i.e., hold the base of X6 in forward bias and the pinch roller solenoid is kept in energized condition.

## 3.7 CONNECTOR

### 3.7.1 Input select circuit (CAMERA/LINE input selection)

A. Video

Electronic switching is employed for input selection. LINE VIDEO IN input is applied to IC1 pin 7 via C8.

In Record mode, with a camera connected, the video signal from pin 1 of 10-pin connector goes to IC1 pin 8. X2 turns on in Record mode, and pin 1 signal is terminated in 75Ω.

The X3 base bias is set to the amplifying bias of only the video signal sync component. The sync component is obtained and amplified by X4. then diode rectified to yield a DC voltage. This DC voltage is applied to IC1, pin 2, and to the base of X5.
IC1 is an electronic switch. When pin 2 is HIGH, the pin-8 input becomes obtained at pin 4. Conversely, with pin 2 LOW, the pin-7 input is obtained at pin 5.

B. Audio

Three audio inputs are provided in the following priorty: 1) MIC, 2) camera mic (10-pin connector) and 3) AUDIO INput. Therefore is recording is performed with signals applied to all 3 inputs, only the MIC signal becomes recorded. In absence of MIC input, camera mic input of 10 pin connector is recorded, while AUDIO IN signal becomes recorded only when MIC and camera mic signals are not connected. This switching is preformed by X5 and S14, which also determines the priority sequence.

In the recording mode, the DC voltage obtained from the rectified sync signal in the video system switches X5 on. Consequently, the LINE AUDIO IN is grounded and the pin-7 input of the 10-pin connector becomes supplied to terminal 51 through R14. When an external MIC is connected, terminal 51 signal becomes grounded and the mic input signal is supplied to terminal 41. The above priority is thus obtained.

C. VF (Viewfinder)

To allow the VHS playback signal to be observed in the camera viewfinder, in Playback mode, the signal from unit is applied from terminal 32 to IC2, pin 8, while 9 V from terminal 56 is applied to IC2, pin 2. The pin-8 signal is obtained from pin 3 and returned to pin 1 of 10-pin connector. In other words, the video signal is applied to DC voltaged employed for camera internal switching operation and returned to the camera.

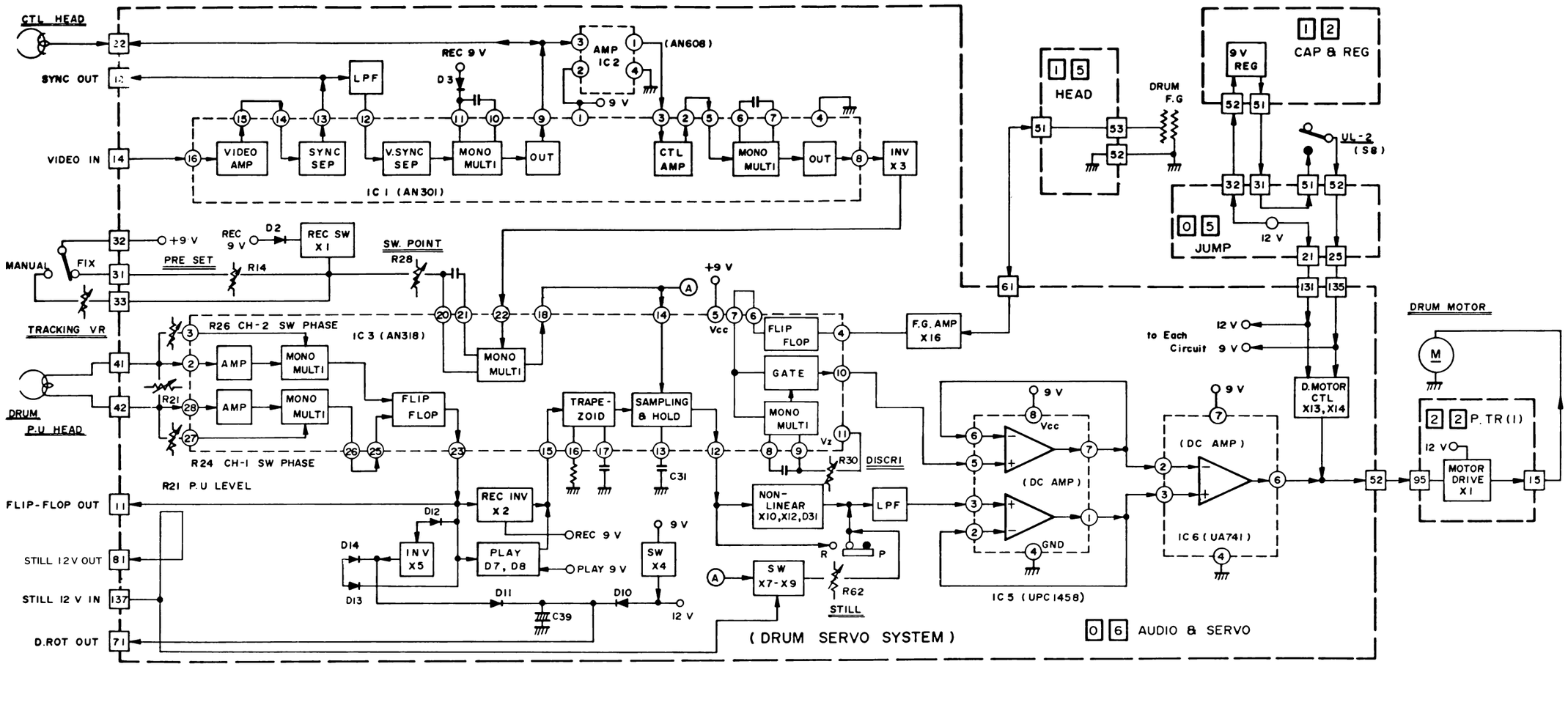



**Fig. 3-62** Drum servo block diagram

# SECTION 4
# DISASSEMBLY

## 4.1 REMOVAL OF CHASSIS

Follow the procedure below to remove the cabinet panels from the chassis.

1. Remove the six screws ① which hold the top panel. Also remove the RF cover, using a coin as shown in Fig. 4-1(a) and (b).

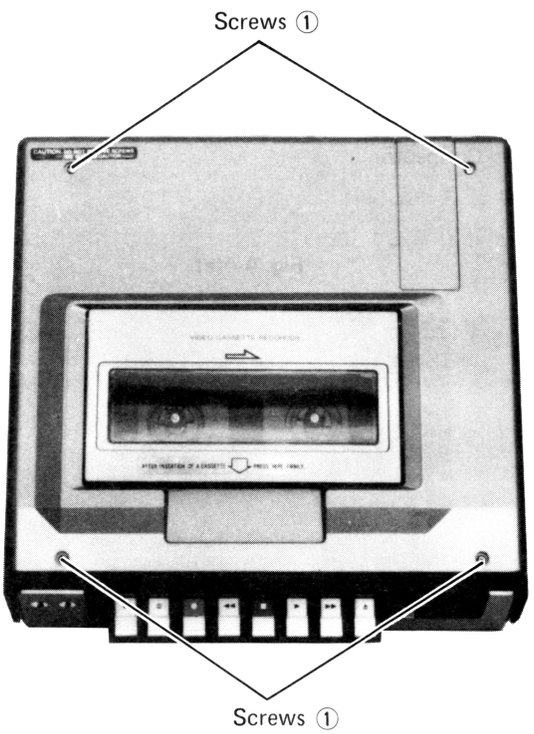



**Fig. 4-1(a)**

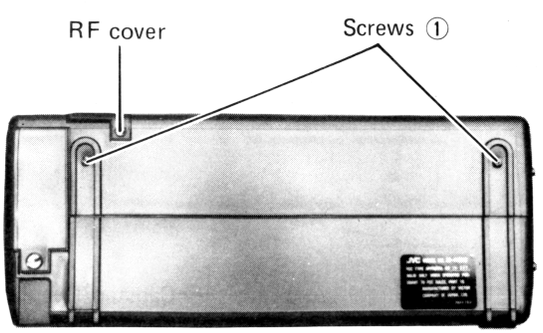



**Fig. 4-1(b)**

2. Remove the battery cover, using a coin as shown in Fig. 4-2.

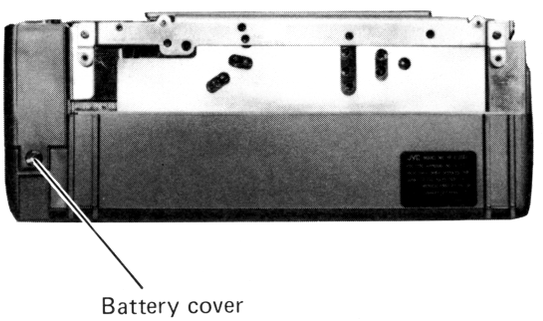



**Fig. 4-2**

3. Remove the four screws ② which hold the bottom cover as shown in Fig. 4-3.

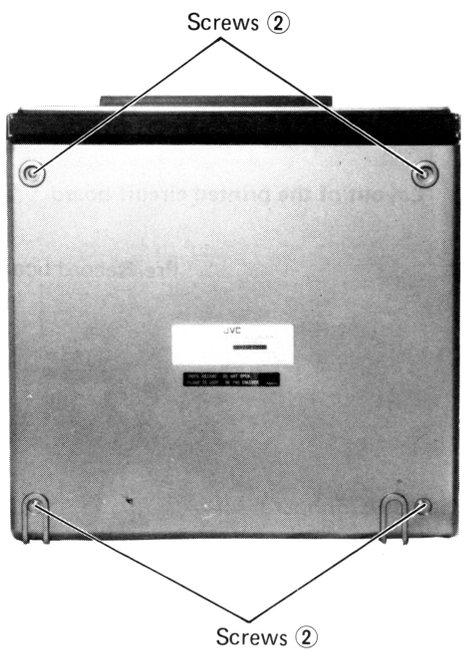



**Fig. 4-3**

NOTE: Remove bottom cover from unit. Use care regarding video connector (BNC) mounted on connector board.

4. Remove the two screws ③ and two screws ④ from each side of the front panel as shown in Fig. 4-4(a) and (b).

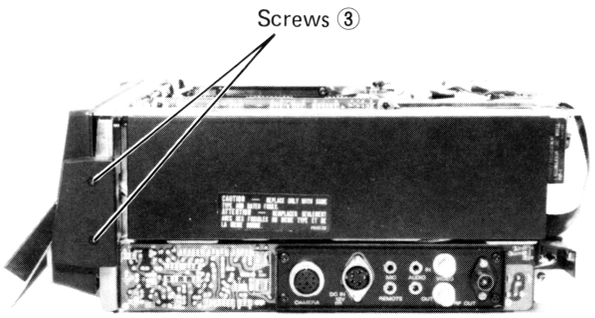



**Fig. 4-4(a)**

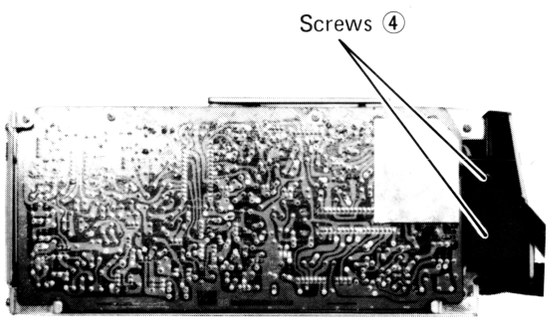



**Fig. 4-4(b)**

5. Disconnect the EMPTY/WARNING lamp connector from the VHS receptacle as shown in Fig. 4-4(c).

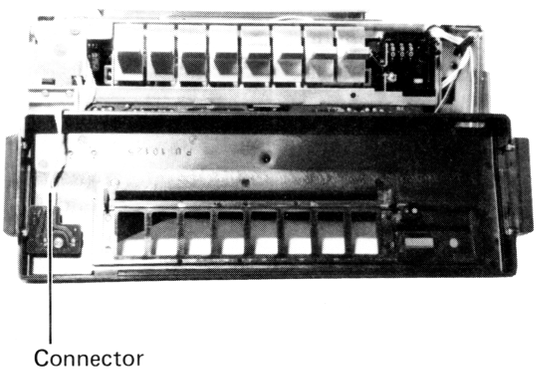



**Fig. 4-4(c)**

## 4.2 REMOVAL OF PRINTED CIRCUIT BOARD

### 4.2.1 Layout of the printed circuit board

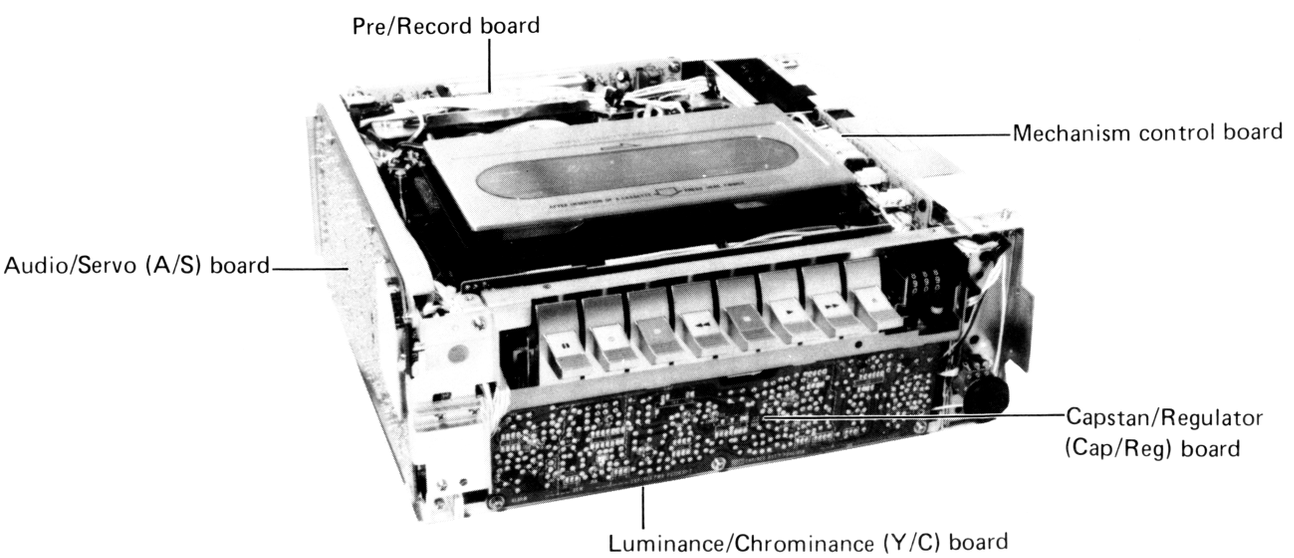



**Fig. 4-5**

### 4.2.2 Audio/Servo (A/S) printed circuit board

1. Remove the two screws ① on the printed circuit board as shown in Fig. 4-6.
2. Remove the printed circuit board by ensuring that slots are out of chassis and then gently pulling outward.
3. Disconnect the connectors from the board.
4. When mounting the Audio/Servo and other printed circuit board, be sure to connect the corresponding numbered connectors to the pin on the board.
   Also when mounting the Audio/Servo printed circuit board to the chassis, make sure that the two slide switch activating levers, located near the middle of the printed circuit board, are manually fully leftward, and take care not to pinch the wires when mounting.

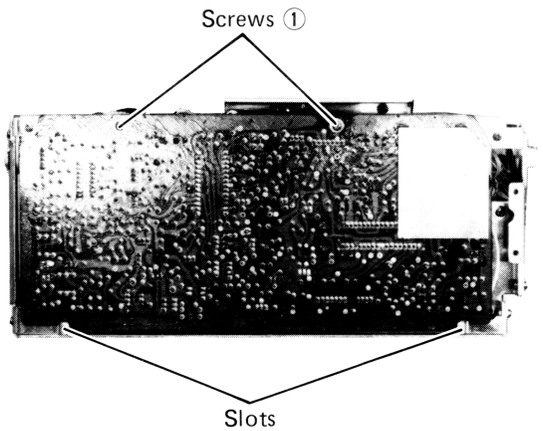



**Fig. 4-6**

### 4.2.3 Pre/Record (PRE/REC) printed circuit board

1. Remove the two screws ② on the chassis, then remove the two screws ③ on the printed circuit board as shown in Fig. 4-7(a).
2. Disconnect the numbered connectors on the printed board.
3. Remove the shield case by using a soldering iron, and unsolder the two wires located inside of the shield case as shown in Fig. 4-7(b).

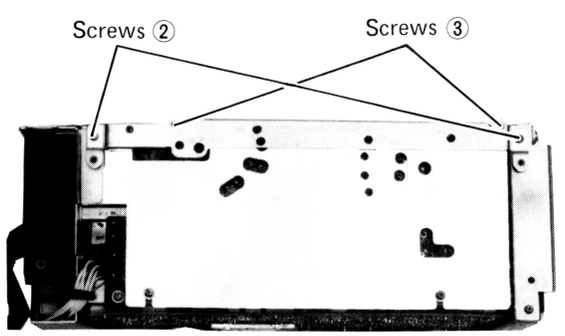



**Fig. 4-7(a)**

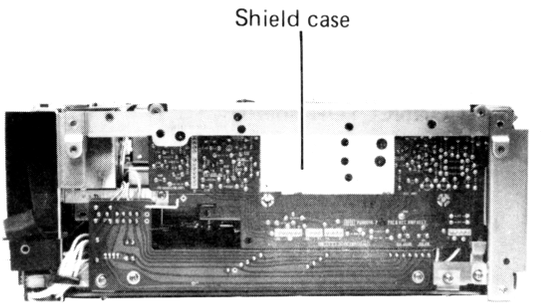



**Fig. 4-7(b)**

### 4.2.4 Luminance/Chrominance (Y/C) printed circuit board

1. Remove the two screws ④ on the printed circuit board as shown in Fig. 4-8.

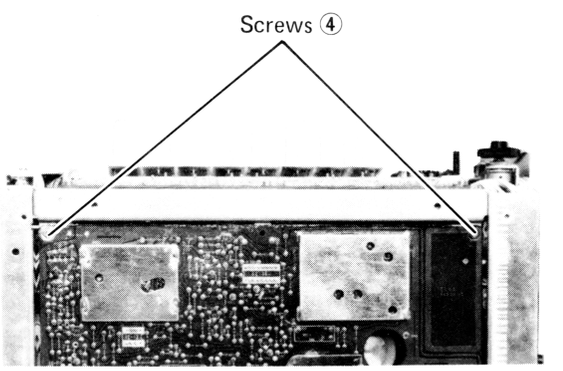



**Fig. 4-8**

2. Disconnect the numbered connectors on the printed circuit board.

### 4.2.5 Capstan&Regulator (Cap./Reg.) circuit board

1. Remove the three screws ⑤ on the printed circuit board as shown in Fig. 4-9.

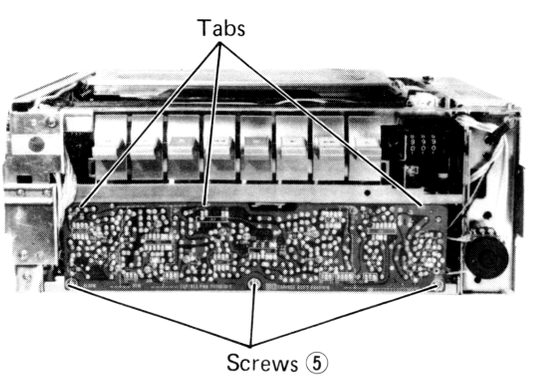



**Fig. 4-9**

2. Remove the printed circuit board by ensuring that tabs are out of chassis and gently pulling outward.
3. Disconnect the numbered connectors on the printed circuit board.

### 4.2.6 CONNECTOR board

1. Remove the five screws (6) on the circuit board as shown in Fig. 4-10.
2. Unsolder the wires from the connectors.

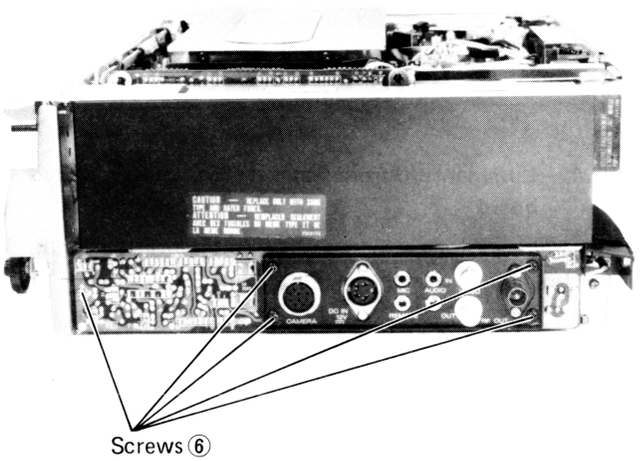



**Fig. 4-10**

### 4.2.7 Mechanism control circuit board

1. Remove the two plastic rivets on the printed circuit board as shown in Fig. 4-11.
2. Disconnect the numbered connectors on the printed circuit board and unsolder the wires.

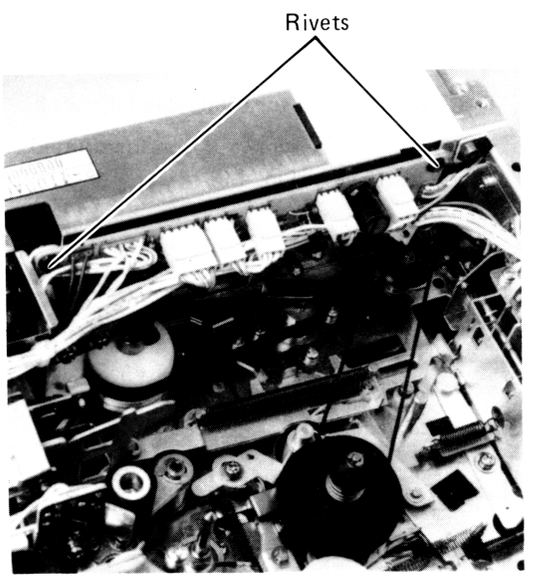



**Fig. 4-11**

# SECTION 5
# MECHANICAL ADJUSTMENTS

## 5.1 PRECAUTIONS

When repairing the unit, the following precautions should be observed.

1. Always turn the power off before removing or soldering components.
2. When removing a screw from the chassis, be careful not to drop it into the mechanism. If a screw should be dropped, be sure to retrieve it.
3. Be extremely careful not to damage either the upper or lower head drum assemblies.
4. The tape transport mechanism has been precisely adjusted at the factory and ordinarily need not be re-adjusted.
5. When removing a part, be very careful not to damage or displace other parts. (Be especially careful with the guide poles and rotary video head drum.)
6. To check the mechanism without a tape, lock the cassette microswitch (S12). Also cover the photo transistor sensor so that the no light falls on it.

NOTE: After the check and repair are completed, do not forget to remove the covering.

## 5.2 PERIODIC MAINTENANCE

The following components need periodic cleaning and lubrication to maintain normal efficiency.

### 5.2.1 Cleaning

A. Drum system

1. Clean the upper and lower drums, the full-erase head, the two guide poles and two guide rollers occasionally. Since these parts make direct contact with the video tape, they tend to collect dust.

   CAUTION: When cleaning the two video heads on the upper drum, DO NOT clean them with a vertical stroke. Use only a gentle back and forth motion, in the direction of the tape path, being very careful since they are made of ferrite and may be broken easily.

2. For cleaning, use a lint-free cloth dampended with pure isopropyl alcohol.
3. The drum system should be cleaned after every 400–500 hours of use.
4. After cleaning with alcohol, allow the parts to dry before using a cassette tape since alcohol on these parts may impair the tape.

B. Pinch roller and capstan shaft

1. Dust on the pinch roller or the capstan shaft can impair their operation.
2. Clean the pinch roller surface, brush and the capstan shaft with a mild detergent solution and a lint-free cloth.
   NOTE: Alcohol can deteriorate rubber.

C. Reel drive system

The following components need periodic cleaning. (Refer to Fig. 5-1(a).)

1. Surface of the supply reel disk ㉘
2. Surface of the rewind idler ㉔
3. Surface of the F.F. pulley ㉒
4. Surface of the unloading idler ㉖

D. Motor drive system

Drum pulley, Drum belt, Drum motor pulley, Capstan motor pulley, Relay belt, Relay pulley, Capstan pulley, Capstan flywheel, Reel drive belt, Unloading belt, Take-up pulley, Rewind pulley, Unloading pulley.

### 5.2.2 Lubrication

The following points should be lubricated with JVC oil (Part No. PU41761) or other high quality spindle oil every 2000 hours.

Shaft of counter idler pulley,
Shaft of take-up and supply reel disk.

CAUTION: DO NOT overlubricate. Two or three drops of oil in each location is sufficient.

## 5.3 LAYOUT OF MAIN MECHANICAL PARTS

A. Top view and parts identification

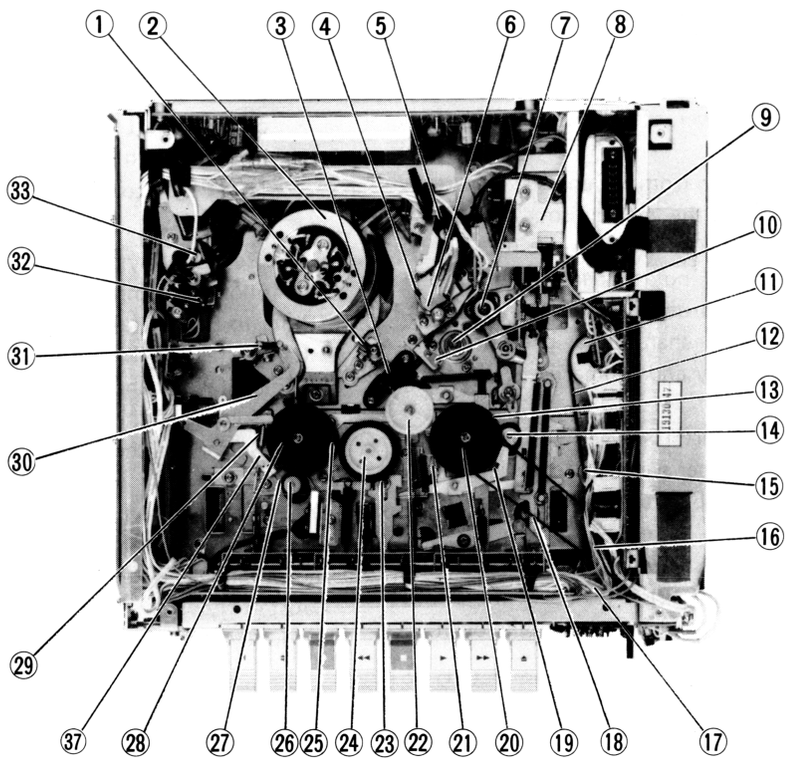



**Fig. 5-1(a)**

1. Take-up loading arm
2. Upper drum (Video heads)
3. Cassette lamp
4. Audio erase head
5. Take-up impedance roller
6. Audio/control head
7. Pinch roller
8. Pinch roller solenoid
9. Capstan holder ass'y
10. Capstan brush ass'y
11. Relay pulley ass'y
12. Relay belt
13. Take-up reel disk rubber tire
14. Take-up idler ass'y
15. Capstan motor pulley
16. Counter pulley
17. Counter belt-2
18. Counter belt-1
19. Take-up brake
20. Take-up reel disk ass'y
21. Take-up loading brake
22. F F pulley
23. Rewind rubber tire
24. Rewind idler ass'y
25. Tension band ass'y
26. Unloading idler ass'y
27. Unloading idler rubber tire
28. Supply reel disk ass'y
29. Supply loading tension brake
30. Tension arm
31. Supply loading arm
32. Full erase head
33. Supply impedance roller

B. Bottom view and parts identification

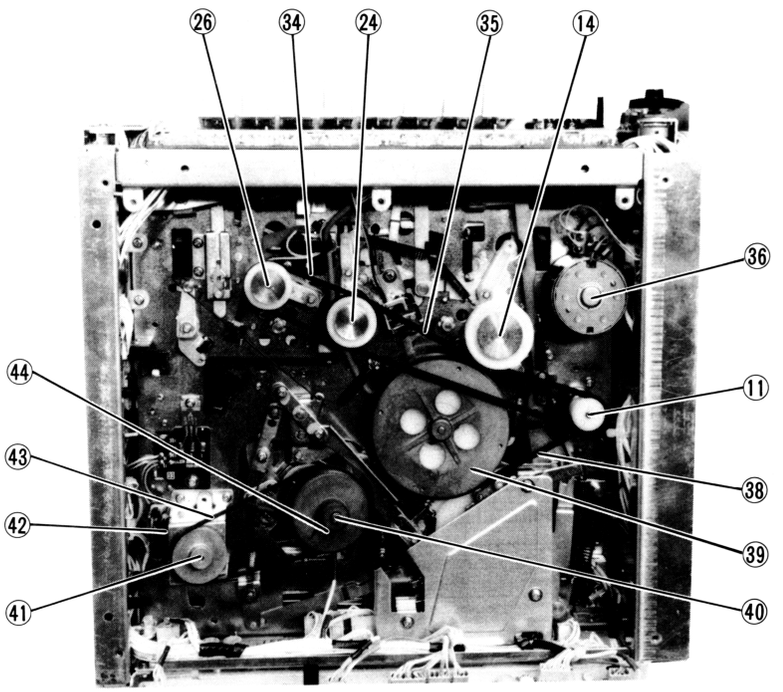



**Fig. 5-1(b)** Bottom view

34. Unloading belt
35. Reel drive belt
36. Capstan motor
37. Supply brake arm
38. Capstan belt
39. Capstan flywheel
40. Drum pulley ass'y
41. Drum motor pulley
42. Drum motor
43. Drum belt
44. Drum brush ass'y

| Name \ Operating hours | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 5000 |
|---|---|---|---|---|---|---|---|---|---|
| Upper drum assembly | C | C/R | C | C/R | C | C/R | C | C/R | C/R |
| Relay belt | | | | R | | | | R | |
| Capstan belt | | | | R | | | | R | |
| Drum belt | | | | R | | | | R | |
| Reel drive belt | | | | R | | | | R | |
| Unloading belt | | | | R | | | | R | |
| Counter belt | | | | R | | | | R | |
| Take-up idler assembly | | C | | C/R | | C | | C/R | |
| Unloading idler assembly | | C | | C/R | | C | | C/R | |
| F.F idler assembly | | C | | C/R | | C | | C/R | |
| Rew. idler assembly | | C | | C/R | | C | | C/R | |
| Pinch roller | | C | | C/R | | C | | C/R | C |
| AUDIO/C.T.L head assembly | C | C | C | C | C | C/R | C | C | C |
| Full erase head | | C | | C | | C | | C | R |
| Supply reel disk assembly | | | | C/L | | | | C/L | |
| Take-up reel disk assembly | | | | C/L | | | | C/L | |
| Drum brush assembly | | C | | C | | C/R | | C/R | C |
| Capstan brush assembly | | C | | C/R | | C | | C/R | C |
| Tension band assembly | | | | R | | | | | R |
| Supply loading tension brake assembly | | | | | | | | | |
| Tape guide | C | C | C | C | C | C | C | C | C |
| Capstan DC motor | | | | | R | | | R | |
| Drum DC motor | | | | | R | | | R | |

key to abbreviations : C : Cleaning
L : Lubrication
R : Replacement

**Table 5-1** Maintenance schedule (normal operating condition)

## 5.4 REPLACEMENT AND ADJUSTMENT

### 5.4.1 Jigs and tools

For proper mechanical adjustment, the following jigs and tools are strongly recommended. Without them, a long trial-and-error period would be necessary.

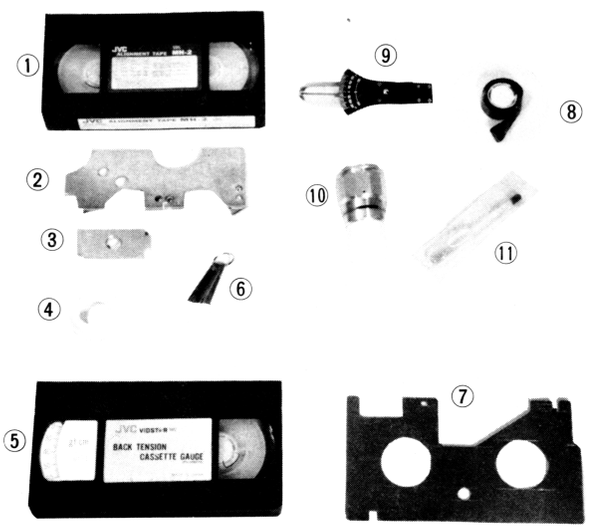



Fig. 5-2 Jigs

| | | |
|---|---|---|
| ① | JVC Alignment Tape | MH-2 |
| ② | Master Plane Jig | PUJ35730 |
| ③ | Reel Disk Height Jig | PUJ48014 |
| ④ | Master Plane Position Jig | PUJ48015 |
| ⑤ | Back Tension Adjustment Jig | PUJ48076 |
| ⑥ | Thickness Gauge | PUJ48017 |
| ⑦ | Cassette housing setting jig | PUJ35881-2 |
| ⑧ | Tension Check Dummy Reel | PUJ48073 |
| ⑨ | Tension Gauge | PUJ48074 |
| ⑩ | Torque Gauge* (600 g-cm torque meter and VHS adapter) | PUJ48075 |
| ⑪ | JVC Oil | PU41761 |

In addition, general-purpose tools and metric hex keys (not supplied by JVC) are required for the following alignment procedures.

### 5.4.2 How to set the master plane jig

1. Set machine to Stop mode.
2. Remove the cassette housing.
3. Remove the capstan brush ass'y
4. Set the master plane jig on the base of the drum assembly as shown in Fig. 5-3(a), then fasten the screw which is provided with the master plane jig.
   NOTE: This is a special metric-thread screw. DO NOT use non-metric thread screw.
5. In the case of the tension pole positioning check, first set the cassette housing positioning jig to the supply reel disk as shown in Fig. 5-3(b), then set the master plane jig with a screw.

NOTE: On the occasion of setting or removing the master plane jig, pay full attention to the drum assembly.

* If you already own a VCR torque gauge (PUJ40049) previously supplied – use Torque Gauge VHS Adapter (PUJ48016) by JVC.

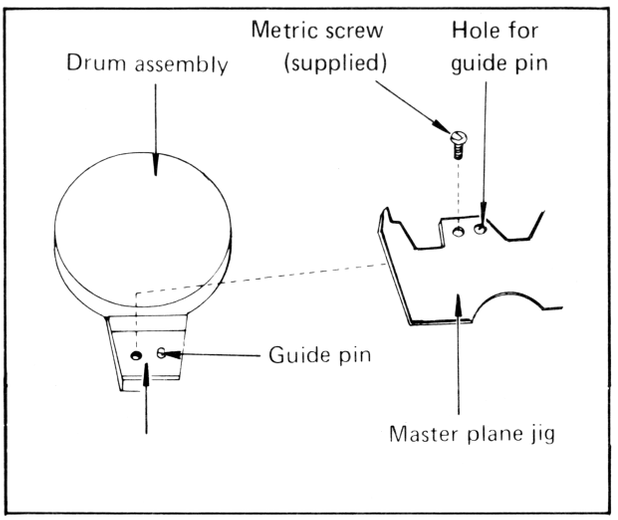



Fig. 5-3(a)

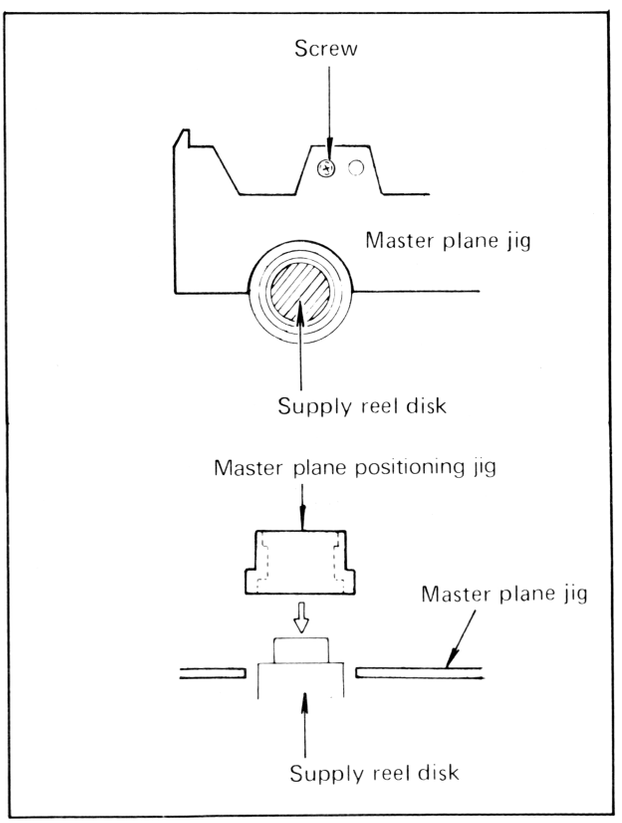



Fig. 5-3(b)

### 5.4.3 Replacement of rubber parts

The follwing belts should be checked for signs of wear every 2000 hours.
Refer to Fig. 5-1 (a) and (b) for location.

| Part No. | Part Name | Symbol No. |
|---|---|---|
| PU44912 | Relay belt | ⑫ |
| PU44918 | Take-up reel disk rubber tire | ⑬ |
| PU44863-2 | Counter belt-2 | ⑰ |
| PU44863 | Counter belt-1 | ⑱ |
| PU44918-2 | Rewind idler rubber tire | ㉓ |
| PU44912-3 | Unloading belt | ㉞ |
| PU44911 | Reel drive belt | ㉟ |
| PU44912-2 | Capstan belt | ㊳ |
| PU44912-5 | Drum belt | ㊸ |

### 5.4.4 Replacement of cassette housing assembly

If the tape transport operates without the cassette being correctly positioned, the tape may be damaged and become unusable. Thus, the cassette housing plays a very important role although its function is rather simple. It is improbable that the cassette housing will become faulty. However, it is occasionally necessary to remove the internal mechanism, and if the housing is not replaced correctly the result will be the same as if the housing were defective.

Removal:

1. Remove four screws a, b, c, d from both sides of the cassette housing assembly as shown in Fig. 5-4.
2. Draw out the cassette housing by lifting it straight up.
   NOTE: When operates the unit without the cassette housing, press the cassette switch (S12) by hand. Also, light from the lamp should be excluded by covering the photo-transistor sensor.

Replacement:

1. Remove the four screws for the cassette cover on the cassette housing and take off the cassette cover.
2. Before you install the cassette housing, check the tilt of stopper A, B of the cassette housing as shown in Fig. 5-5.

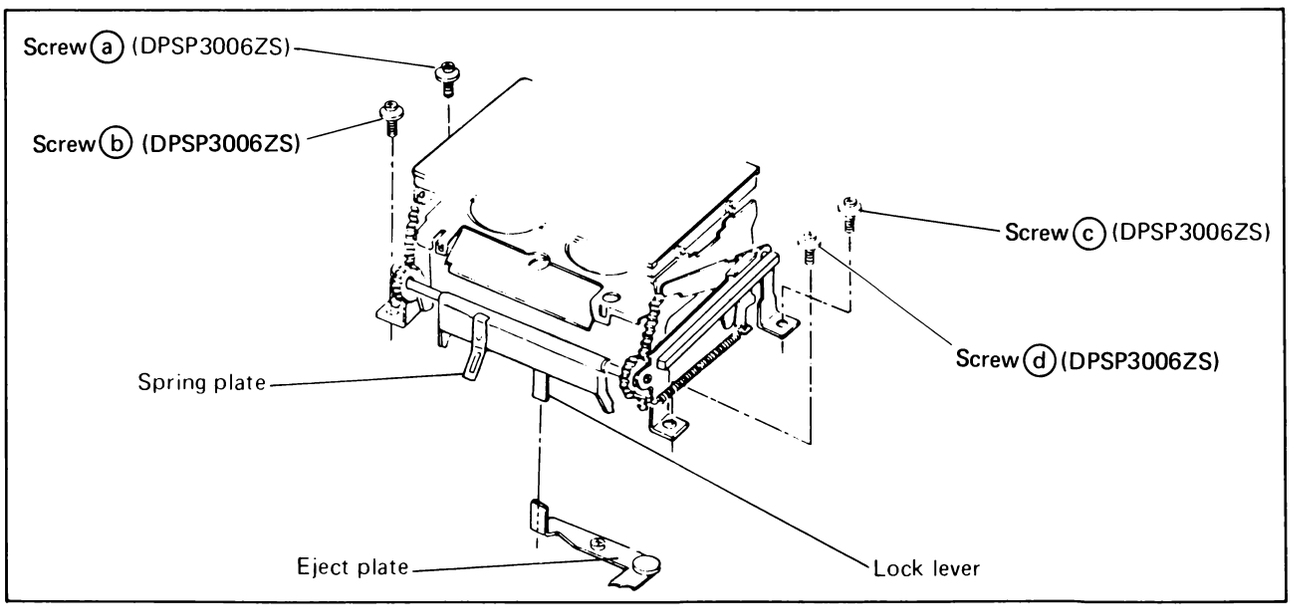



**Fig. 5-4** Replacement of cassette housing

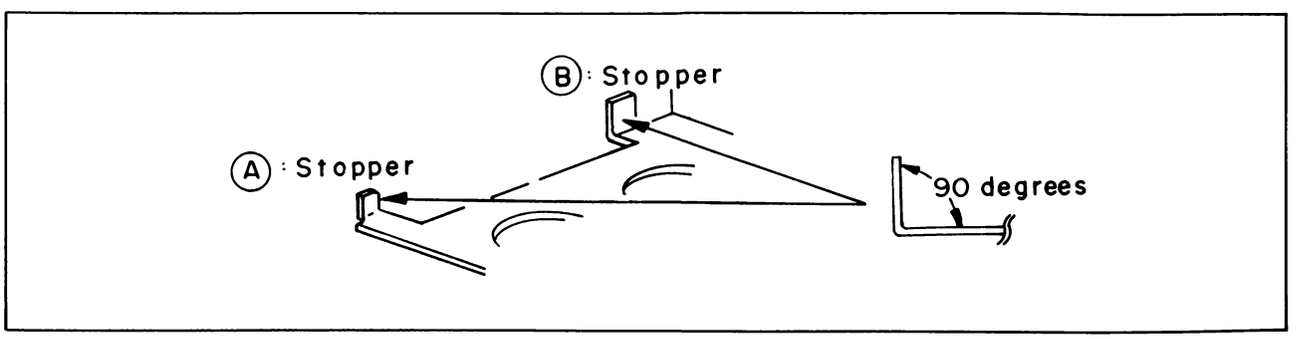



**Fig. 5-5**

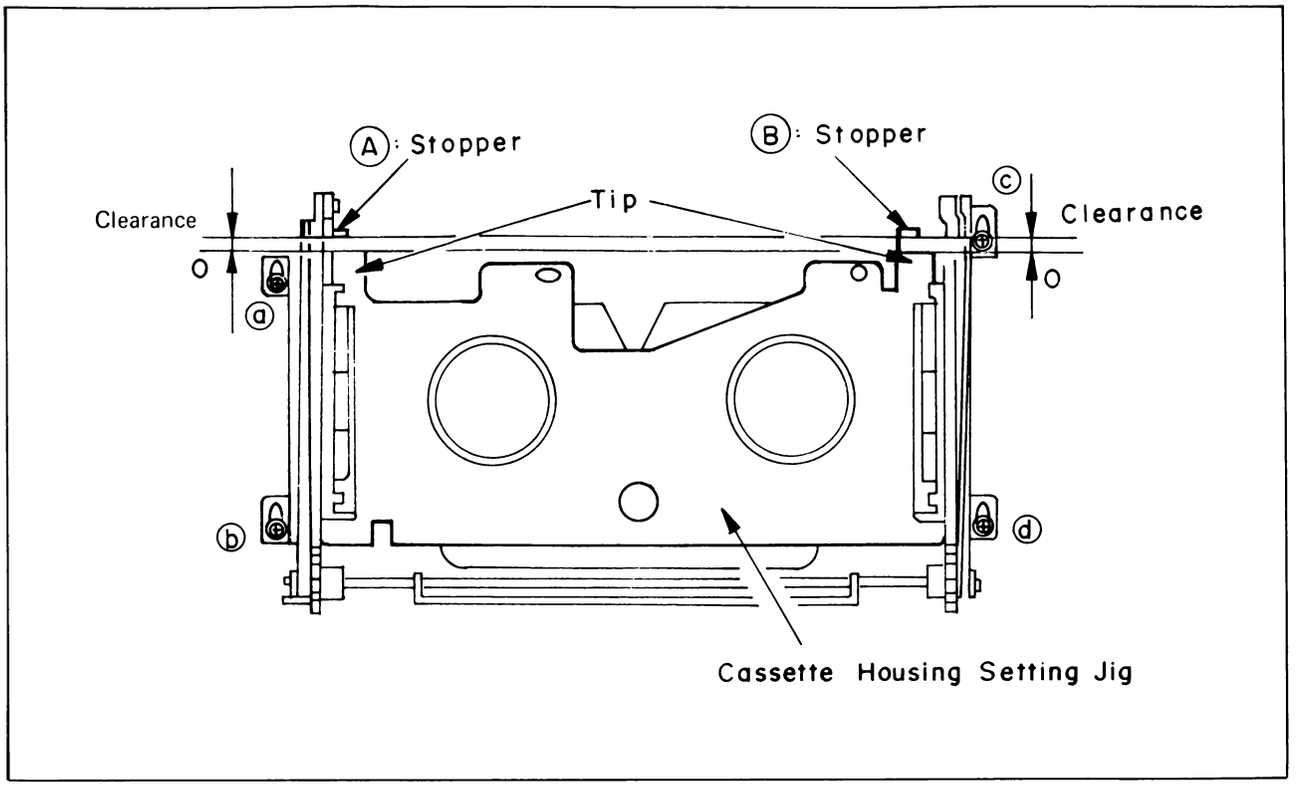



**Fig. 5-6**

If necessary, adjust by bending them.

3. Install the cassette housing on the chassis.
   In this time, set the lock lever on the cassette housing between the eject plate and the function assembly as shown in Fig. 5-5. If the lock lever is not in correct position, the EJECT key will not operate. And also, check that the spring plate touches to the junction assembly.
4. Fasten the four screws a, b, c, d, temporarily. (Refer to Fig. 5-6.)
5. Insert the Cassette Housing Setting Jig slowly into the cassette housing and depress the cassette housing downward to lock-in.
   In this time, check the Cassette Housing Position Jig is loaded correctly like the cassette tape.
6. Fully draw the cassette housing on this side.
   Check the stoppers positions as shown in Fig. 5-6.
   Clearance between the stoppers and tip of the Cassette Housing Setting Jig is zero.
7. On this condition, fasten the four screws in order of a, b, c, d. After fastened four screws, verify again that clearance between the stoppers and tip of the Jig is zero.
8. Depress the Eject Key and remove the Cassette Housing Setting Jig from the cassette housing.
9. Install the cassette cover on the cassette housing and check follows.
10. Insert the new spare cassette tape (E-180) into the cassette housing and depress the cassette housing downward to lock-in slowly.
    In this time, verify that the both right and left sides of the cassette housing are smoothly locked at the same time.
    And when you depress the Eject Key, the cassette housing has to pop up in good spirits.
11. On a condition that the cassette housing is locked, when you move the right or left side of the cassette tape back and forth on your fingers, the cassette tape hav to move without fail.
12. Set the equipment to Rewind (or Fast Forward) mode with the video cassette tape.
    In this time, verify that the tape is rewound smoothly.
13. Set the equipment to Play mode and verify the tape traveling at both poles in the cassette, so that there is no tape wrinkles each edges.

### 5.4.5 Replacement of reel disk

Removal:

1. Remove the cassette housing as referring to sub-section 5.4.4 "Replacement of the cassette housing" Removal.

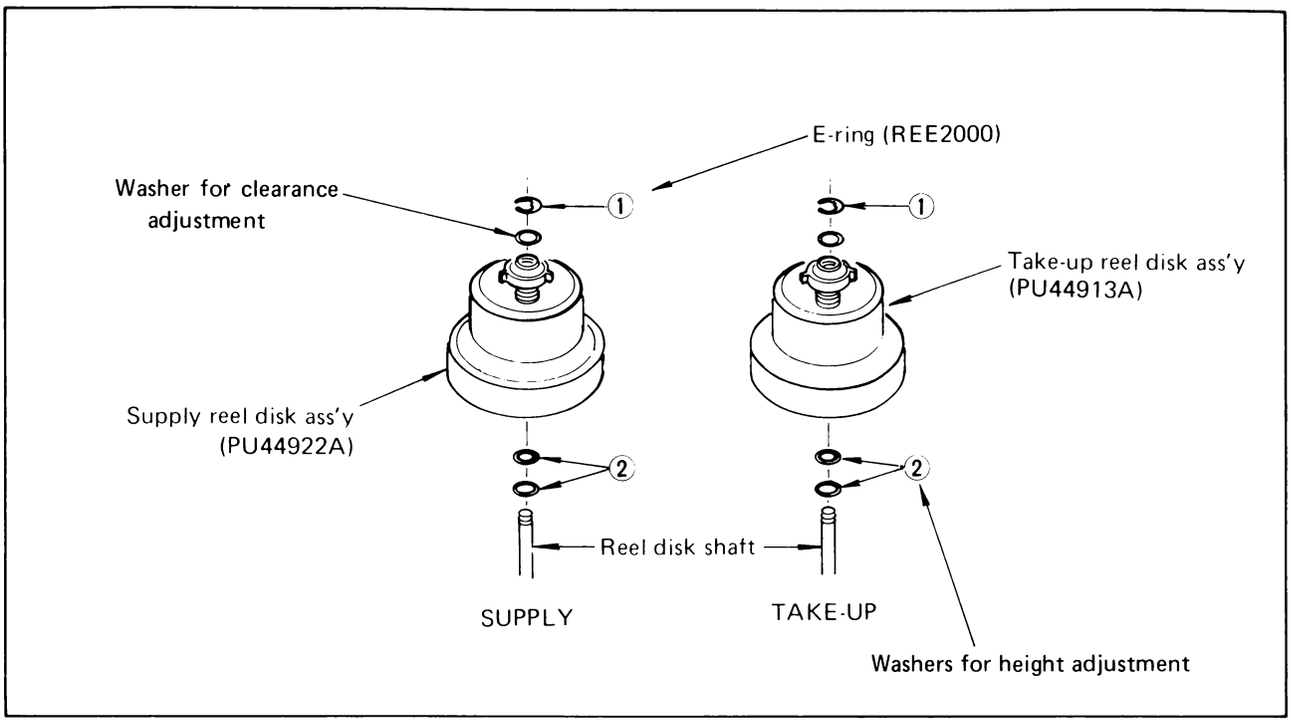
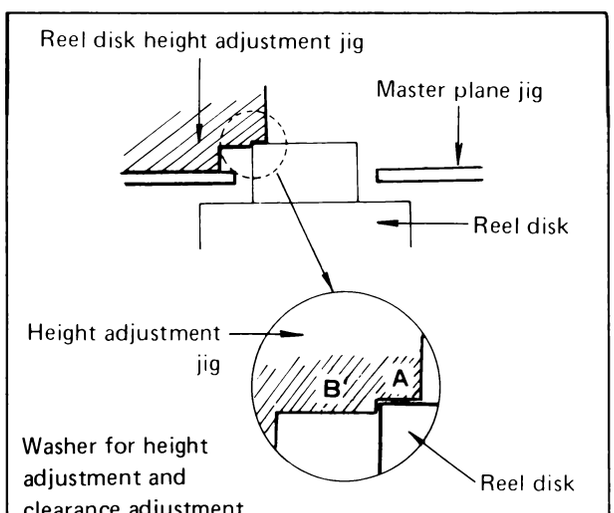



**Fig. 5-7** Replacement of reel disk

2. Remove the E-ring ① located in the top portion of the reel disk as shown in Fig. 5-7.
3. Remove the E-ring on the top of the supply tension arm shaft, then remove the tension band.
   NOTE: When taking off the brake band, be careful of the brake band to avoid bending it. If deformed, the brake band will have to be replaced with a new one.
4. Then take off the reel disk by pulling gently upward.
   NOTE: The metal washers ② at the bottom of the reel disk are apt to come off with the reel disk. Be careful not to lose the metal washers ②.
5. When the new reel disk is set in place, the following adjustment is necessary.

Height adjustment:

1. Set the master plane jig as referring to subsection 5-4-2 "How to set the master plane jig".
2. After the master plane jig is set in place, check the reel disk height by using the height adjustment jig.
3. Place the height adjustment jig on the master plane jig, check the reel disk height to be lower than "A" area and higher than "B" area as shown in Fig. 5-8.
4. To adjust the height, add or remove one or more of the different thickness washers listed in Fig. 5-8.
5. After the height adjustment, adjust the clearance within 0.1–0.2 mm between the E-ring and top of the reel disk with washer.
6. After the height adjustment, lubricate the reel disk shaft. When the supply reel disk is replaced, check the back tension as referring to subsection **5.14.12 "Back tension adjustment"**.




Q03093-834: 0.13 mm (0.005 inch)
Q03093-827: 0.25 mm (0.01 inch)
Q03093-828: 0.5 mm (0.02 inch)

**Fig. 5-8** Reel disk height adjustment

### 5.4.6 Adjustment of the supply loading back tension

1. Remove the cassette housing assembly.
2. Set the unit to Play mode without cassette installed.
3. Turn off the power before loading arm reached to the loading end while pushing the PLAY key by hand, so that the PLAY key locked by the function mechanism after turn off the power.
4. Set the tension check reel on the supply reel disk.
5. Measure the supply loading tension by pulling the video tape, and reading a tension gauge as shown in Fig. 5-9.
   The measured loading tension should be between 40 and 50 grams.

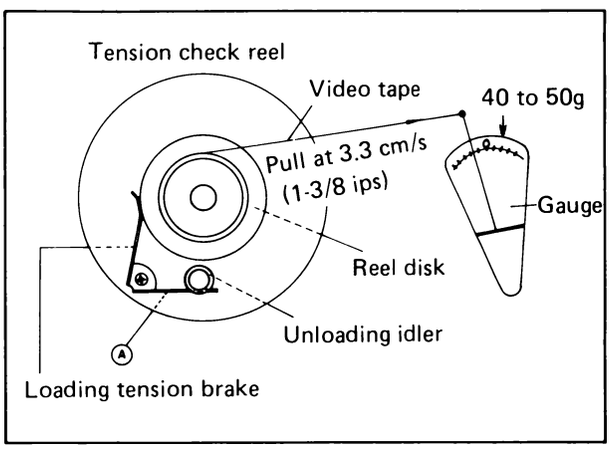



**Fig. 5-9**

6. If not, following adjustment is necessary.
7. If the measured supply loading back tension is greater than 50 grams, bend the supply loading idler lever at point Ⓐ little by little as shown in Fig. 5-10(a).
8. If the measured supply loading tension is less than 40 grams, bend the supply loading lever at point Ⓐ little by little as shown in Fig. 5-10(b).

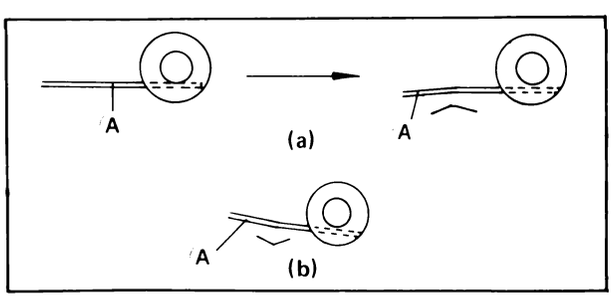



**Fig. 5-10**

9. After adjustment, measure the supply loading tension again
   Then, check that the correct tape transport is obtained in loading and unloading, and also that tape travels smoothly with no evident wrinkles during loading and unloading near-by beginning of the cassette tape (E-180).

**NOTE:** If set the cassette tape without the cassette housing, press down the cassette tape to top of the studs by using the cassette holder jig.

### 5.4.7 Adjustment of take-up loading brake

1. Remove the cassette housing assembly.
2. Set the unit to play mode without cassette housing installed.
3. Turn off the power before loading arm reached to the loading end while pushing the PLAY key by hand, and PLAY key locked by the function mechanism after turn off the power.
4. Set the tension check reel on the take-up reel disk.
5. Measure the take-up loading tension by pulling the video tape, and reading a tension gauge as shown in Fig. 5-11. The measured loading tension should be between 30 and 40 grams.

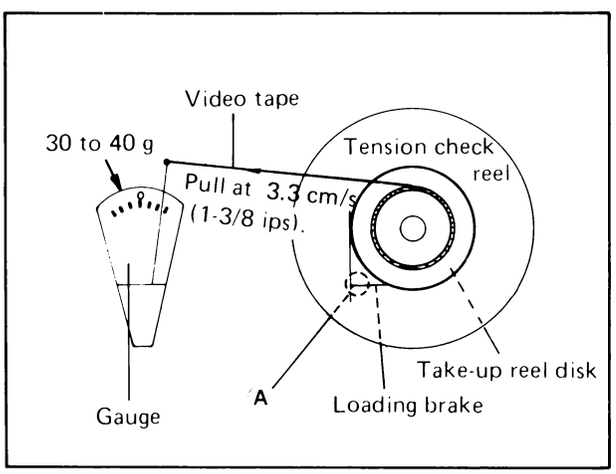



**Fig. 5-11** Measurement of take-up loading tension

6. If not the following adjustment is necessary.
7. If measured take-up loading tension is greater than 40 grams, bend the take-up loading brake lever at point Ⓐ little by little as shown in Fig. 5-12(a).

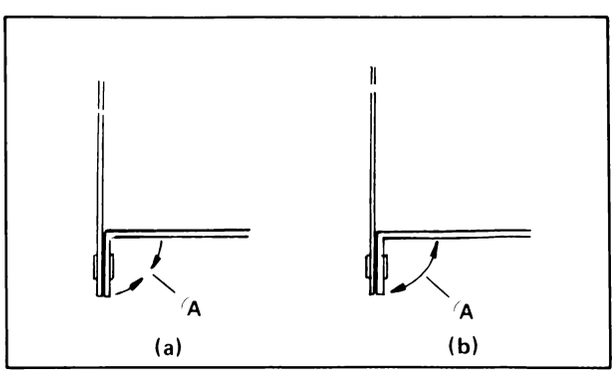



**Fig. 5-12**

8. If measured take-up loading tension is less than 30 grams, bend the take-up loading brake lever at point Ⓐ little by little as shown in Fig. 5-12(b).

9. After adjustment, measure the take-up loading tension again, also check that the correct tape transport is obtained in loading and unloading near-by end of the cassette tape (E-180).

### 5.4.8 Checking rewind torque

1. Remove the cassette housing assembly.
2. Set the unit to Rewind mode without cassette tape. Before measurement, clean the following drive system as referring to subsection 5.2.1 "Cleaning".
   - Reel drive belt
   - Rubber tire of rewind idler
   - Rewind idler
   - Supply reel disk.
3. Check the rewind torque by attaching the torque meter to supply reel disk.
4. Gradually loosen the gripped torque meter in your hand, and read the meter while the torque meter is slowly-slipping in your hand.
5. A proper rewind torque is more than 270 grams.
6. If the rewind torque is less than 270 grams, check the wear of reel drive belt or rubber part of rewind idler assembly.
7. If the rewind torque is excessively different, replace the rewind idler assembly.
8. Remove the rubber tire of rewind idler assembly from upside of the unit.
9. Remove the E-ring from the shaft.
10. Remove the rewind idler assembly.
11. After the new rewind idler assembly is set in place, then measure the rewind torque again.

### 5.4.9 Checking F.F. (fast forward) torque

1. Remove the cassette housing assembly.
2. Set the unit to F.F. mode without cassette tape.
3. Check the F.F. torque by attaching the torque meter to take-up reel disk.
4. Gradually loosen the gripped torque meter in your hand, and read the meter while the torque meter is slowly-slipping in your hand.
   A proper F.F. torque is more than 270 grams.
5. If the F.F. torque is less than 270 grams, clean the following drive system.
   - Rubber tire of rewind idler
   - Rubber tire of take-up reel disk
   - F.F idler

### 5.4.10 Adjustment of take-up torque

1. Remove the cassette housing assembly.
2. Set the unit to Record mode without cassette tape.
3. Before measurement, keep the unit to Record mode about two minutes. Set the unit to Pause mode, then set the torque meter to the take-up reel disk and push the memory plate little by hand.
4. Gradually loosen the gripped torque meter in your hand, and read the meter while the torque meter is slowly-slipping in your hand.
   A proper take-up torque is between 80–220 grams.
   If not following adjustment is necessary.

Adjustment

Before adjustment, clean the following drive system as referring to subsection 5.2.1 "Cleaning".

- Reel drive belt
- Take-up idler
- Take-up reel disk.

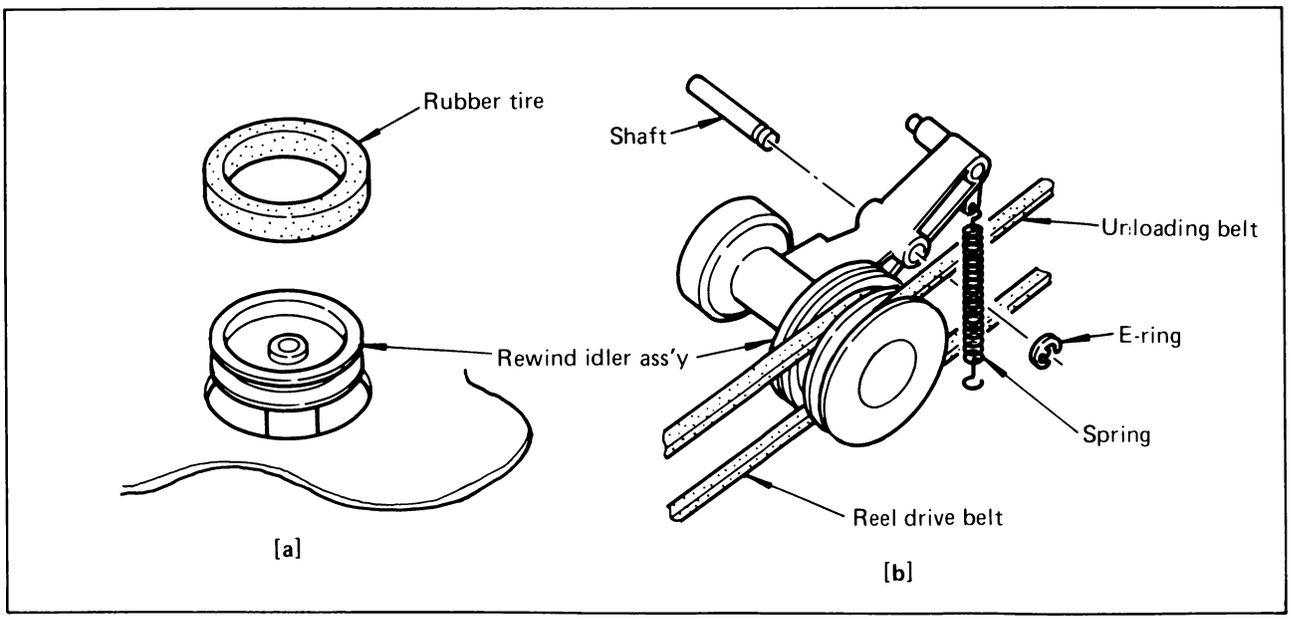



Fig. 5-13

1. If the take-up torque is less than proper torque, adjust the position of spring of the take-up idler assembly to direction of arrow (a) as shown in Fig. 5-14, then measure the take-up torque again.
2. If the take-up torque is greater than proper torque, set the spring of take-up idler assembly to arrow (b) as shown in Fig. 5-14, then measure the take-up torque again.

NOTE: When adjust the spring of take-up idler assembly, always turn the spring to direction of arrow (c).
Do not set the spring to (G) position.

Replacement
In the case the torque is still out of order as a result of adjustment, following replacement is necessary.

1. Remove the E-ring and spring as shown in Fig. 5-15.
2. Take off the take-up idler assembly.
   After the new take-up idler assembly is set in place, then measure the take-up torque again.

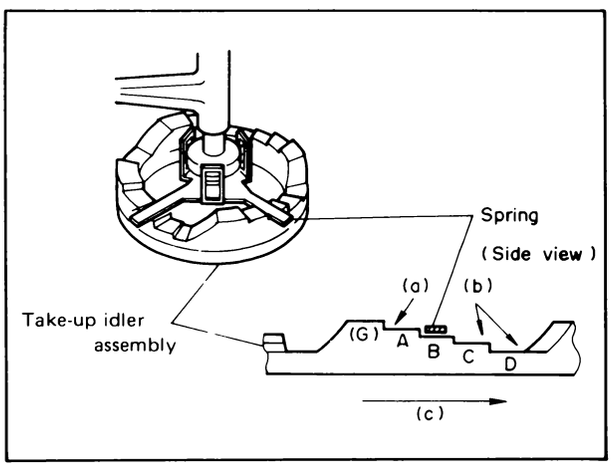



**Fig. 5-14** Take-up idler assembly

### 5.4.11 Adjustment of unloading torque

1. Remove the cassette housing assembly.
2. Before measurement, clean the following drive system as referring to subsection 5.2.1 "Cleaning".
   - Reel drive belt
   - Rewind pulley
   - Unloading pulley
   - Rubber tire of unloading idler
   - Supply reel disk
3. Set the torque meter to the supply reel disk, and push the memory plate to direction of arrow (A) as shown in Fig. 5-16, then gradually loosen the gripped torque meter in your hand, and read the meter while torque meter is slowly slipping in your hand.
4. A proper torque is between 50 and 220 grams.
5. If not, following replacement is necessary.
6. If the unloading torque is much less than 80 grams, check the wear of reel drive belt and rubber tire of unloading idler. Replace it if necessary.
7. If the unloading torque is still out-of-spec, replace the unloading idler assembly.
8. Remove the E-ring and spring as shown in Fig. 5-17.
9. Take off the unloading idler assembly.
   After the new unloading idler assembly is set in place, then measure the unloading torque again.

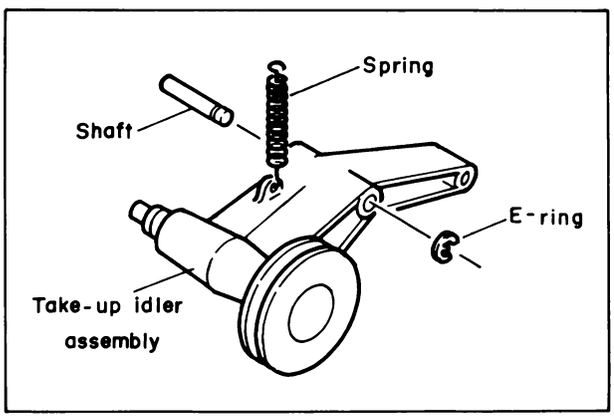



**Fig. 5-15** Take-up idler assembly

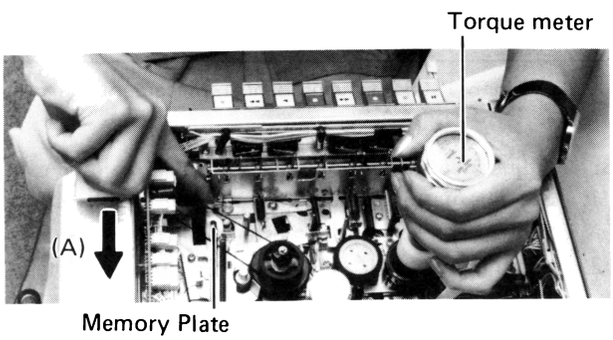



**Fig. 5-16**

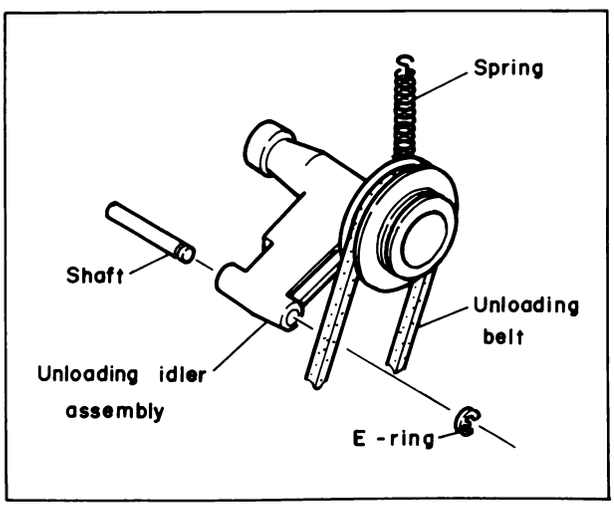



**Fig. 5-17** Unloading idler assembly

### 5.4.12 Back tension adjustment

A: Tension band replacement.

1. Remove the cassette housing assembly.
2. Remove the screw ① , ② and tension band assembly ③ from the chassis as shown in Fig. 5-18(a).
3. Install the new tension band ass'y and tigten the screws ① and ② with collar ④ .

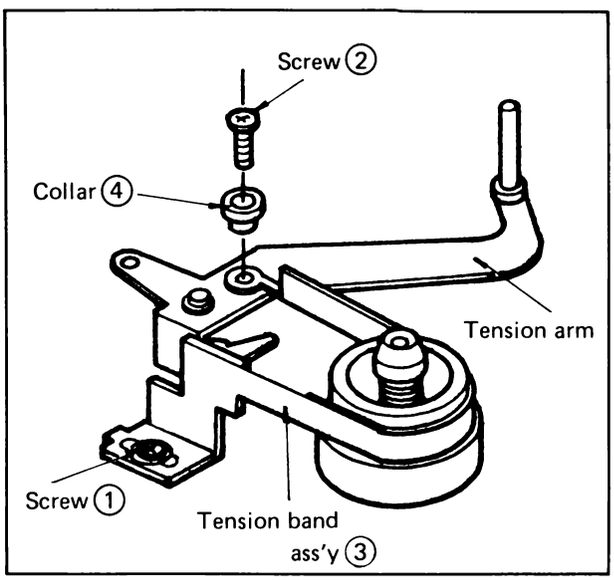



**Fig. 5-18(a)** Tension band replacement

B: Adjustment of tension pole position

1. Set the master plane jig as referring to subsection 5.4.2 "How to set the master plane jig".
2. Set the unit to Play mode with E-180 cassette tape (tape end condition).
3. After tape starts traveling, check the tension pole position as shown in Fig. 5-18(b). Clearance between tension pole and tip of master plane jig is 1.5 mm (0.06 inches).
4. If not, adjust the position of plate ④ by using screw ③ as shown in 5-18(b).

C: Back-tension adjustment

1. Set the back-tension adjustment jig to the unit and set to Play mode.
2. Read the meter in adjustment jig while meter is slowly-rotating in the cassette. A proper back tension is 28 to 45 grams.
3. If not following adjustment is necessary.
4. If measured back-tension is greater than 45 grams or less than 28 grams, adjust position of adjust plate ② by loosening screw ① , so that the back-tension should be 35 grams, then fasten screw ① as shown in Fig. 5-19.

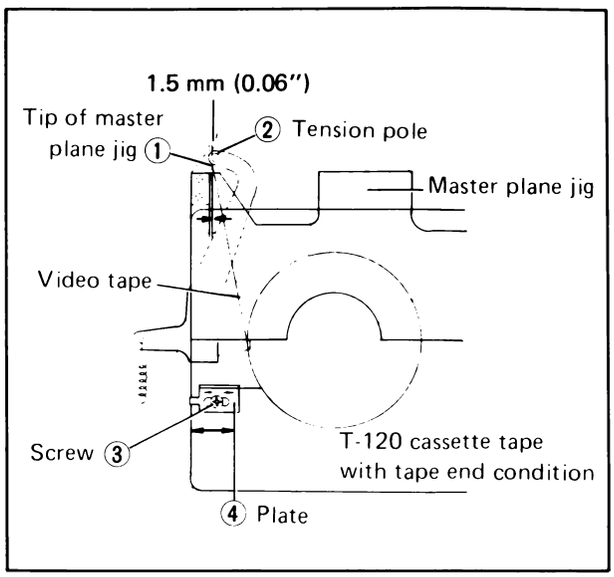



**Fig. 5-18(b)** Back tension adjustment

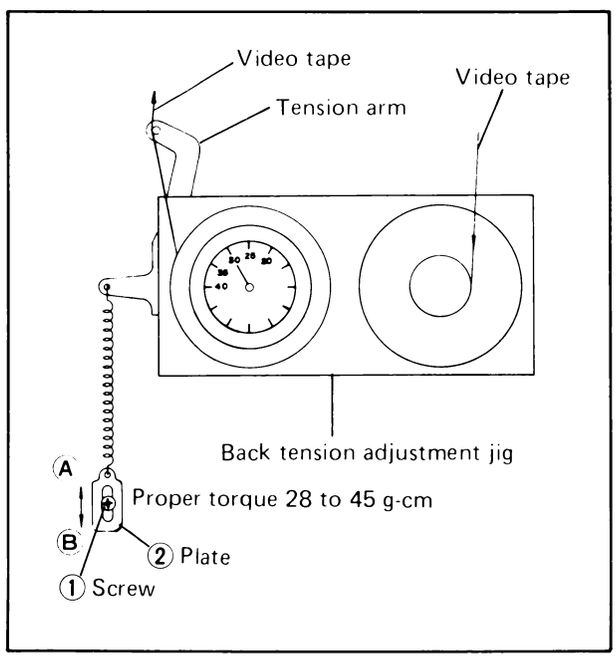



**Fig. 5-19** Back tension adjustment

5. After adjustment, set the unit to Play mode with E-180 cassette tape (beginning of tape condition), check the position of tension pole. In this time, the tension pole is not touching the bracket of cassette housing.
6. Recording and then play back the picture, check the switching point which is 3.5 horizontal lines before the V-blanking signal, so that there is no skew problem at the switching point.

### 5.4.13 Replacement of capstan motor

1. Remove the four screws and belt guard from the chassis as shown in Fig. 5-20.
2. Remove the capstan motor pulley by using metric hex key.
3. When mounting a motor pulley to a DC motor, be careful to install on a motor shaft exactly as shown in Fig. 5-21. Set 1.0 mm thickness gauge between motor and motor pulley, then fasten the setscrew.
4. After replacement, verify the belt running position. Also servo circuit adjustment subsection 6.3, "Adjustment of capstan servo".

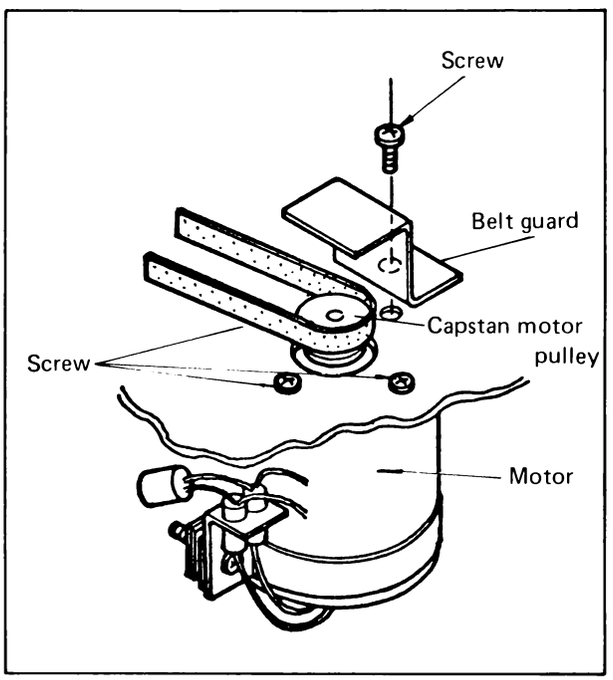



**Fig. 5-20** Capstan motor replacement

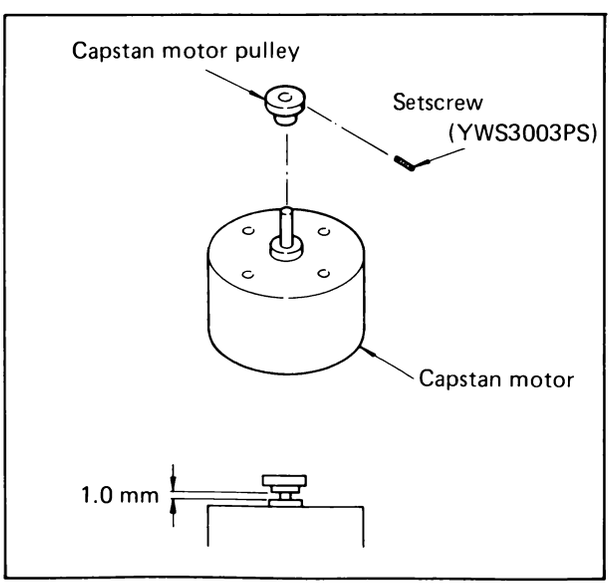



**Fig. 5-21**

### 5.4.14 Replacement of drum motor

1. Remove the drum belt, and remove three screws as shown in Fig. 5-22.
2. Remove drum motor pulley with a metric hex key and, then remove the drum DC motor by loosening three screws.
3. When mounting a motor pulley to a DC motor, set 1.2 mm thickness gauge between drum motor and motor pulley as shown in Fig. 5-23.
   After replacement, verify the belt running position in play mode. Also adjustment of drum servo circuit is necessary. (Refer to subsection 6.3)

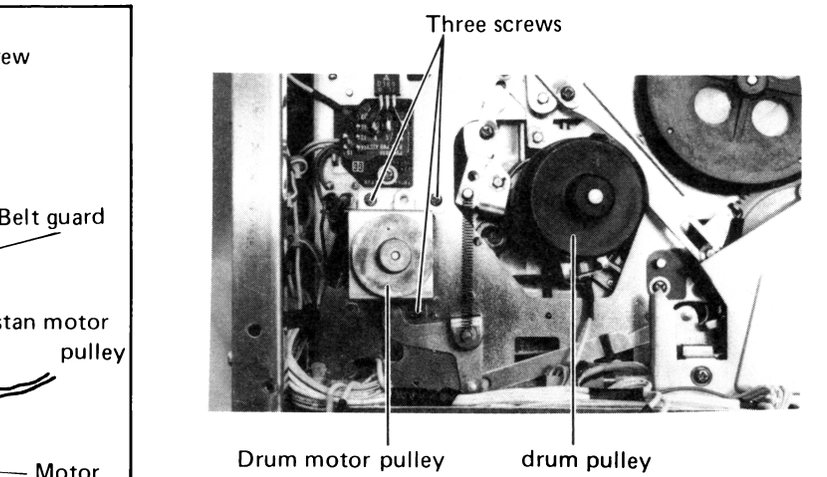



**Fig. 5-22** Replacement of drum motor

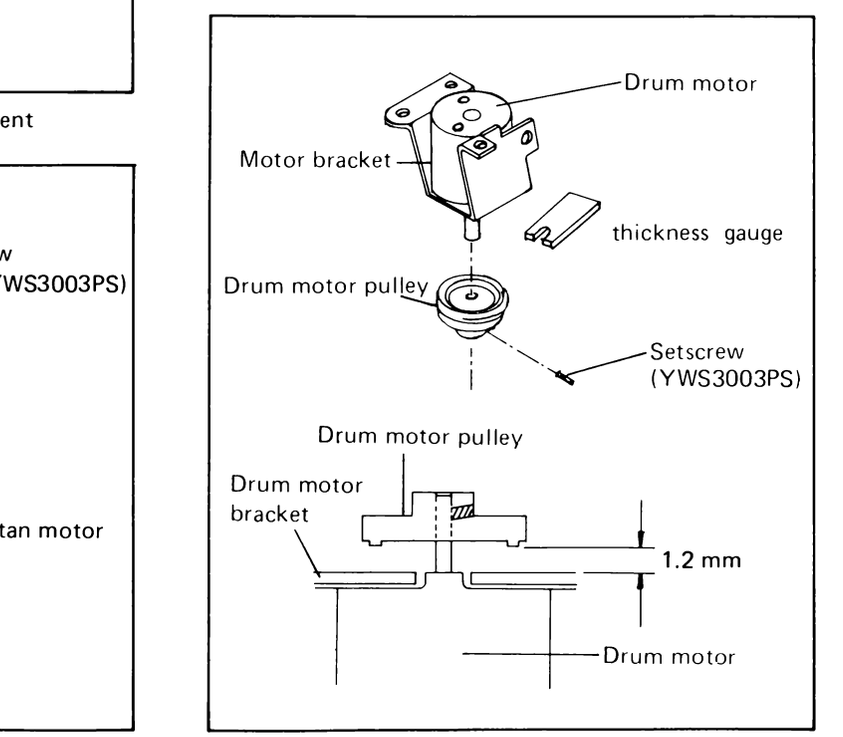



**Fig. 5-23**

### 5.4.15 Replacement of audio/control head assembly

A: Replacement

1. Remove three screws Ⓐ,Ⓑ,Ⓒ as shown in Fig. 5-24.
2. Unsolder the Mini printed board located behind the audio/control head.
3. Solder the Mini printed board to the new head assembly.
   NOTE: Do not damage the head surface.
4. Install the new head assembly in the correct position by using three screws Ⓐ,Ⓑ,Ⓒ as shown in Fig. 5-24.

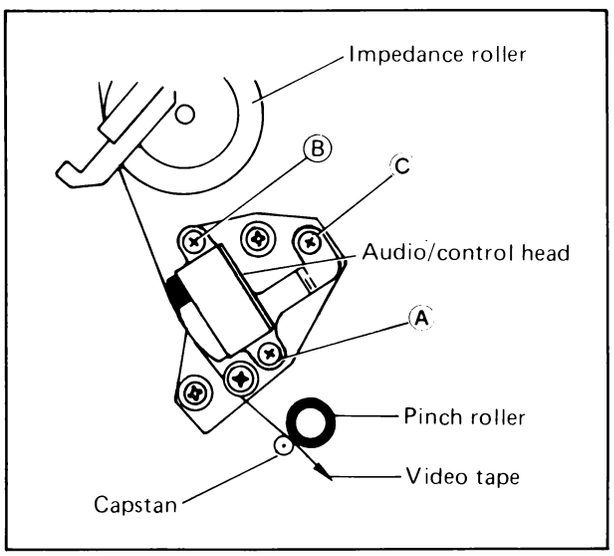



**Fig. 5-24**

B: Adjustment

1. Before adjustment, check the tape travel between guide roller – take-up impedance roller – guide pole – capstan shaft with a spare cassette tape, so that the tape should be travel smoothly with no wrinkles.
2. If an unsatisfactory condition is found by the above check, adjust the three screws Ⓐ,Ⓑ,Ⓒ by turning in small increments. Do not adjust the guide poles. The normalized tape travel is shown in Fig. 5-25.
3. Connect the oscilloscope to TP-11 on the audio amplifier of Audio and Servo printed circuit board.
4. After normal tape traveling is obtained, playback the JVC alignment tape to reproduce the audio 7 kHz signal.
   NOTE: Do not use the JVC alignment tape, before smooth tape traveling is assured. Otherwise, it may be damaged.
5. Adjust the screw Ⓐ,Ⓑ,Ⓒ for the playback signal at TP-11 to be maximim.
6. After adjustment, verify the head height as shown in Fig. 5-25. And also, check for smooth tape traveling.
7. When replace the audio/control head following electrical adjustment is necessary.
   ●Subsection 6.6 'Adjustment of audio circuit".
8. The preceding steps provide for complete adjustment of the audio/control head assembly. Finally, by recording and then playing back the video, confirm that the playback picture is normal. Again, as a final check, playback to reproduce the monoscope segment from the JVC alignment tape. Also check the FM output level at TP-7 on Pre-Rec amplifier printed circuit board to be maximum at Tracking potentiometer "Auto" position.

### 5.4.16 Replacement of video head assembly

1. Unsolder the wire ①, then unsolder the brown wire ② and red wire ③.
2. Remove the two screws ④, then pull-up the upper drum assembly.
3. Install the new head assembly and solder the wires as shown in Fig. 5-26.
4. Fasten two screws ④.

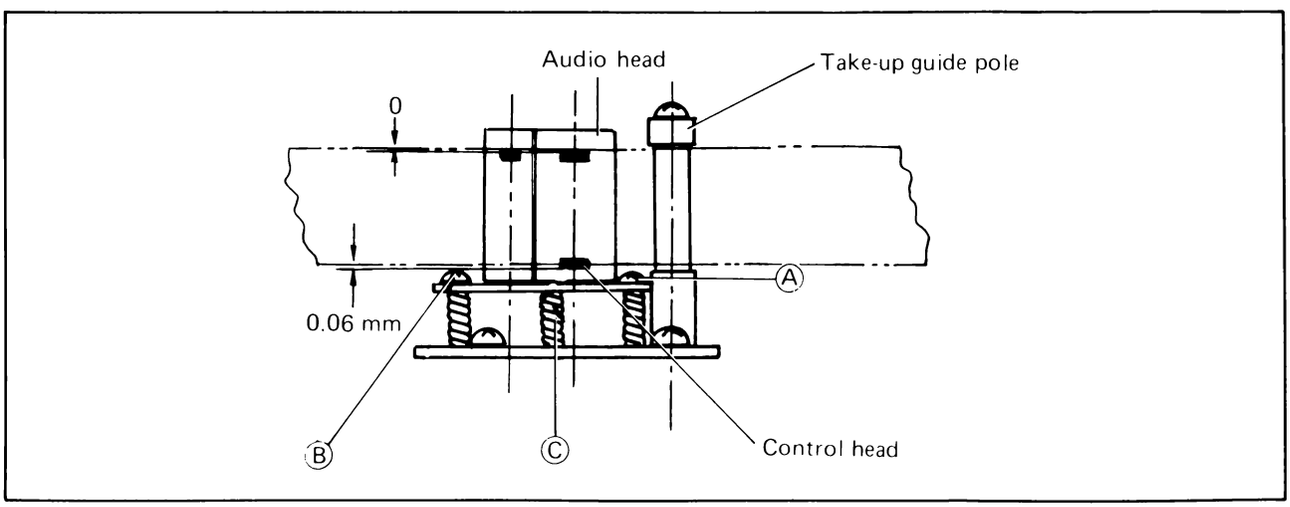



**Fig. 5-25**

5. After replacement, the following adjustment is necessary.
   1) Playback switching point adjustment (subsection 6.3.12).
   2) Recording switching point adjustment (subsection 6.3.13).
   3) Tracking adjustment (subsection 6.3.14, 6.3.15).
   4) Video head Q (Quality factor) and resonance adjustment (subsection 6.4.1).
   5) Playback FM channel balance (subsection 6.4.2).
   6) Playback color channel balance and color level (subsection 6.5.4, 6.5.5).
   7) Recording color channel balance and color level (subsection 6.5.10).
   8) Checking of D.O.C. (Dropout compensator) level (subsection 6.4.3).

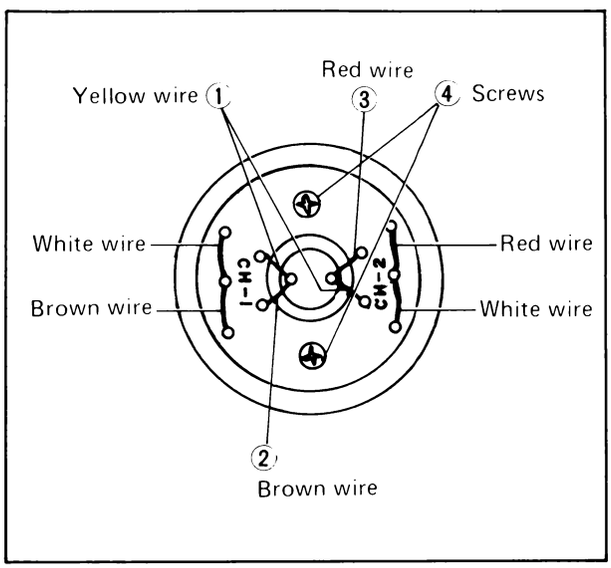



**Fig. 5-26** Replacement of video head assembly

### 5.4.17 Pinch roller replacement

1. Remove the screw (A) and pinch roller assembly.
2. Carefully install a new roller assembly refer to Fig. 5-27.
   NOTE: If the pinch roller assembly is installed in the opposite position, rotation will not be smooth.

### 5.4.18 Check of pinch roller pressure

1. Set the unit to play mode without video cassete.
2. Check the clearance between the pin of pinch roller lever ass'y and pause lever ass'y as shown in Fig. 5-28.
3. If out of specification, loosen the three screws (A) securing the pinch solenoid ass'y to chassis and slightly adjust front-to-rear position of solenoid bracket as shown in Fig. 5-29, then check again.

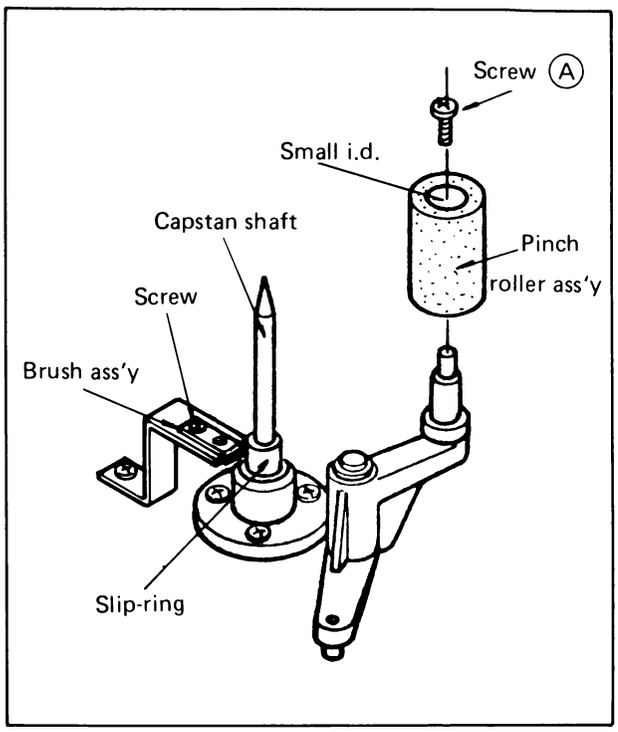



**Fig. 5-27**

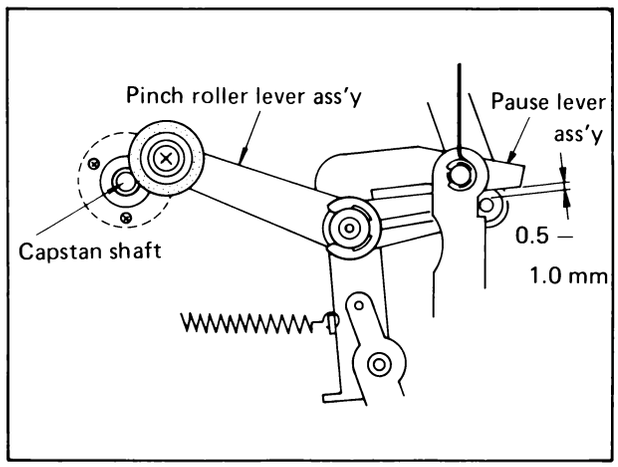



**Fig. 5-28**

NOTE: Absence of spacing reduces tape tension and impairs stable tape transport.

### 5.4.19 Check of pinch roller solenoid operation

1. Set the unit to play mode without video cassette.
2. Check the clearance between the roller of lever ass'y and lever as shown in Fig. 5-29.
3. If out of specification, loosen two screws (B) and slightly adjust lever ass'y front to rear position, then check again.
4. With pinch roller solenoid ON, confirm that pinch switch (SII) is michanically OFF. Also confirm opposite.

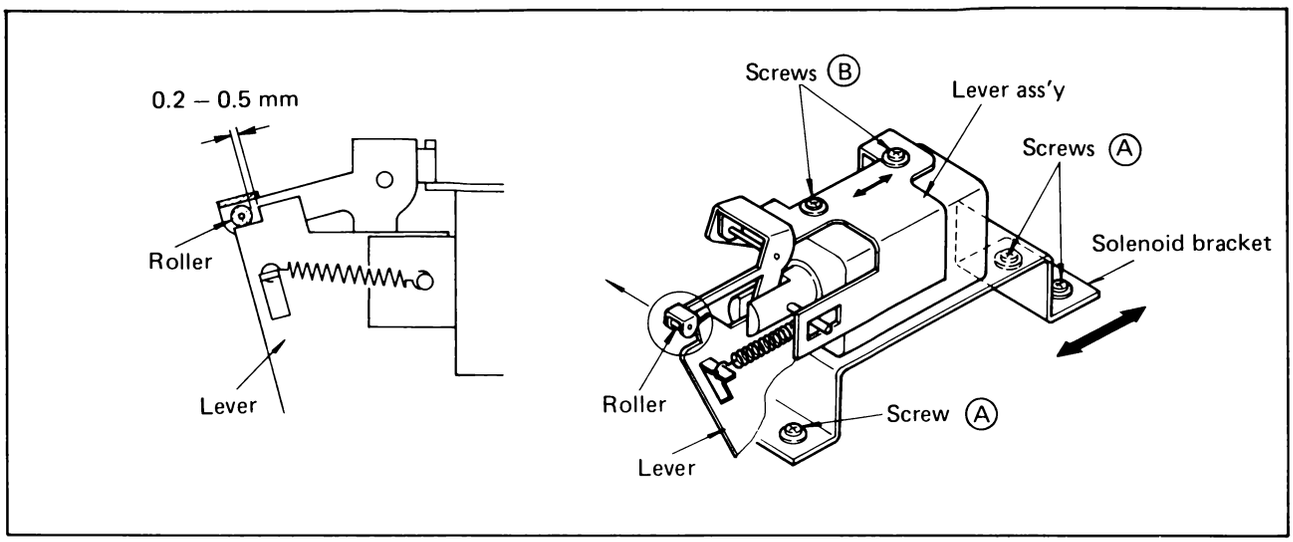



Fig. 5-29

5. In Pause mode, brake shall be applied to take up reel disk and supply reel disk, i.e.: brake shall function when pinch roller solenoid is de-energized.

### 5.4.20 TU(Take-up) idler off lever

1. Set the unit to Record mode without a video cassette.
2. Confirm presence of TU idler off lever play, as shown in Fig. 5-30.

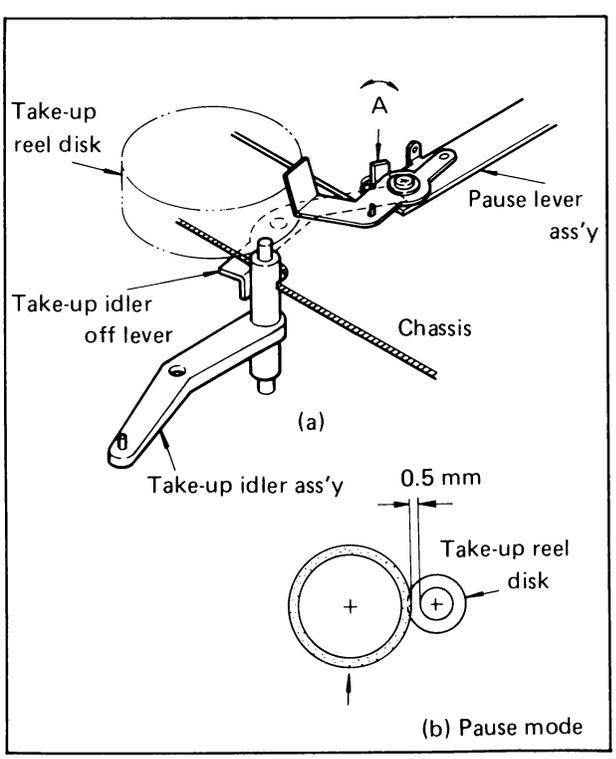



Fig. 5-30

NOTE: Absence of play (i.e., spacing) reduces TU torque or prevents rotation. Conversely if play is excessive, take up idler may not separate from take up reel disk during Pause mode and tape may be taken up.

3. During pause mode, confirm that TU idler separates from TU reel disk.
4. If necessary, adjust by bending section A of TU idler off lever.

### 5.4.21 Plate (PU 45325) Installation

1. With power OFF, press PLAY key.
2. Turn capstan flywheel by hand and stop just prior to Play mode, i.e.: stop at point T=5 mm, as shown in Fig. 5-31.
3. At this point, secure plate with three screws.

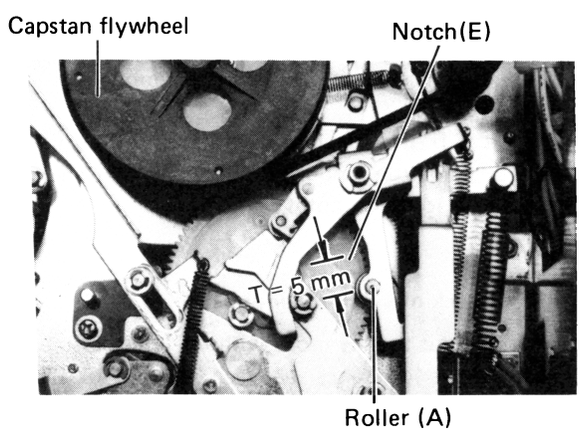



Fig. 5-31

(Secure at point with maximum load applied to overall mechanism.)

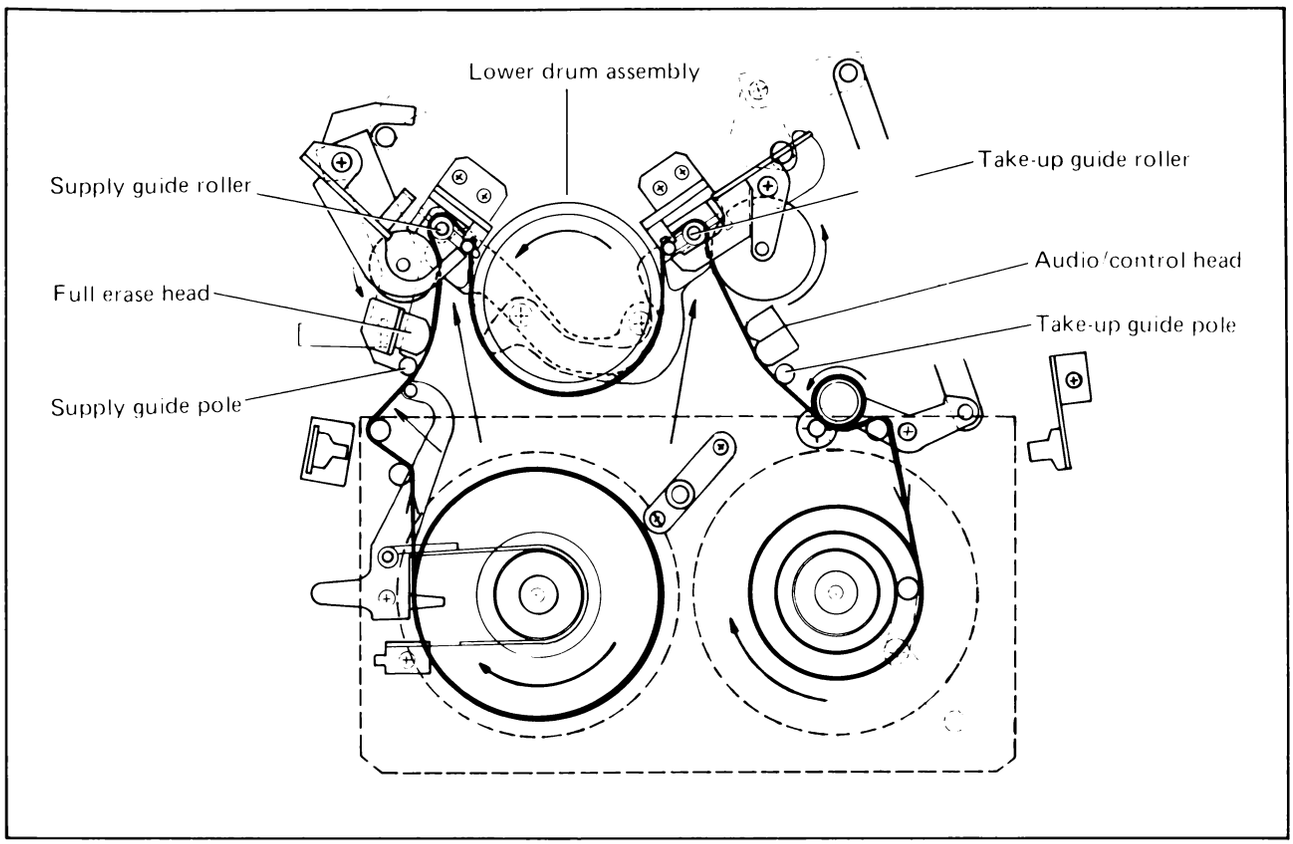



**Fig. 5-32** Tape path

### 5.4.22 Tape transport system checking

It is very important for this video cassette recorder, that in the Play mode the tape travels in a smooth, uncreased path from the tape outlet of the video cassette to tape inlet of the video cassette. This section is very carefully factory-adjusted. When a part associated with this section (such as the supply back-tension pole, audio/control head assembly, pinch roller assembly, etc.) has been replaced, the tape transport must be checked according to the procedure described in the applicable section. It is important that faulty tape travel subsequent to replacement of parts must be remedied by adjusting those parts directly involved in the replacement. This makes it possible to obtain a tape path equal to original factory-adjusted. If this is neglected and other parts (guide pole, etc.) are adjusted, a good result (for tape transport adjustment) can never be obtained.
Do NOT touch the two guide poles.

For checking of tape path, observe the following steps.

A: Tension pole

1. Set the unit to Play mode with cassette tape installed.
2. While tape traveling, check the tape path at the outlet of the cassette tape and the supply back tension pole, there is no tape wrinkles as shown in Fig. 5-33.
3. if not, check the tension pole parallelism and reel disk height (Refor to subsection 5.4.5)
4. Set the master plane jig as referring to subsection 5.4.2.
5. Set the unit to Play mode without cassette tape installed.
6. Place the reel disk height adjustment jig on the master plane jig and adjust the tilt of the tension pole as shown in Fig. 5-34.
   After adjustment, check the tape path again.

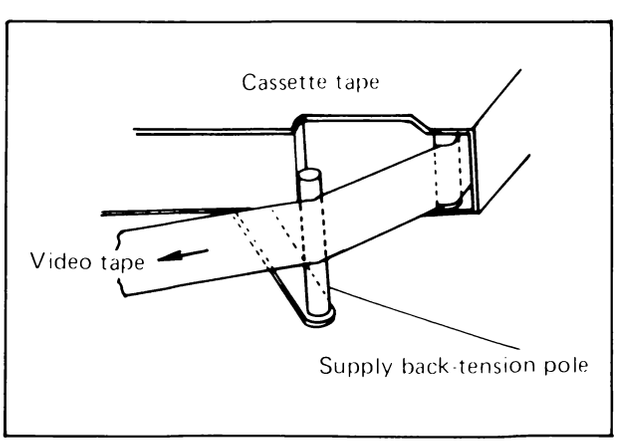



**Fig. 5-33**

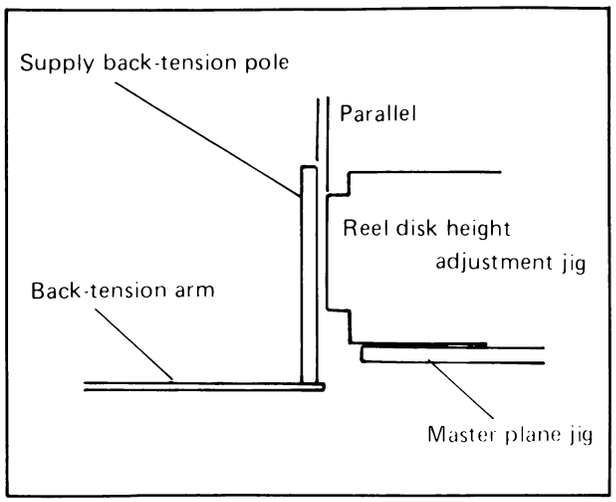



Fig. 5-34

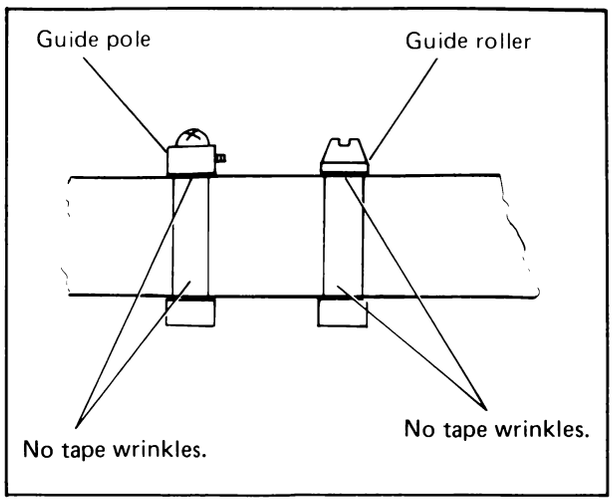



Fig. 5-35

B: Supply guide pole, Full erase head, Guide rollers, Take-up guide pole

1. Set the unit to Play mode with cassette tape installed.
2. Verify the tape traveling at the supply guide pole, full erase head, guide rollers and take-up guide pole, so that there is no tape wrinkles as shown in Fig. 5-35.

### 5.4.23 Function key check

A: Function key

1. After press the PLAY key, other function keys will not operate except STOP and PAUSE keys.
2. After press the F.F. key, other function keys will not operate except STOP and PAUSE keys.
3. After press the REW key, other function keys will not operate except STOP and PAUSE keys.
4. After pressing the PAUSE key, FULL REC (full record) and AF REC (after record) key will operate with cassette tape equipped with safety tab.
5. When press the STOP key from the play mode, function key will not operate during unloading except STOP and PAUSE keys.

B: Function microswitch

1. When press the PLAY, F.F. or REW key, microswitch (S1) and (S16) are both operated.
2. When press the PLAY key, microswitch (S2) is turned on.
3. When press the REW key, microswitch (S3) is turned on.
4. When press the PAUSE key, microswitch (S5) is turned on.
5. When press the RECORD key, micro switch (S4) is turned on.

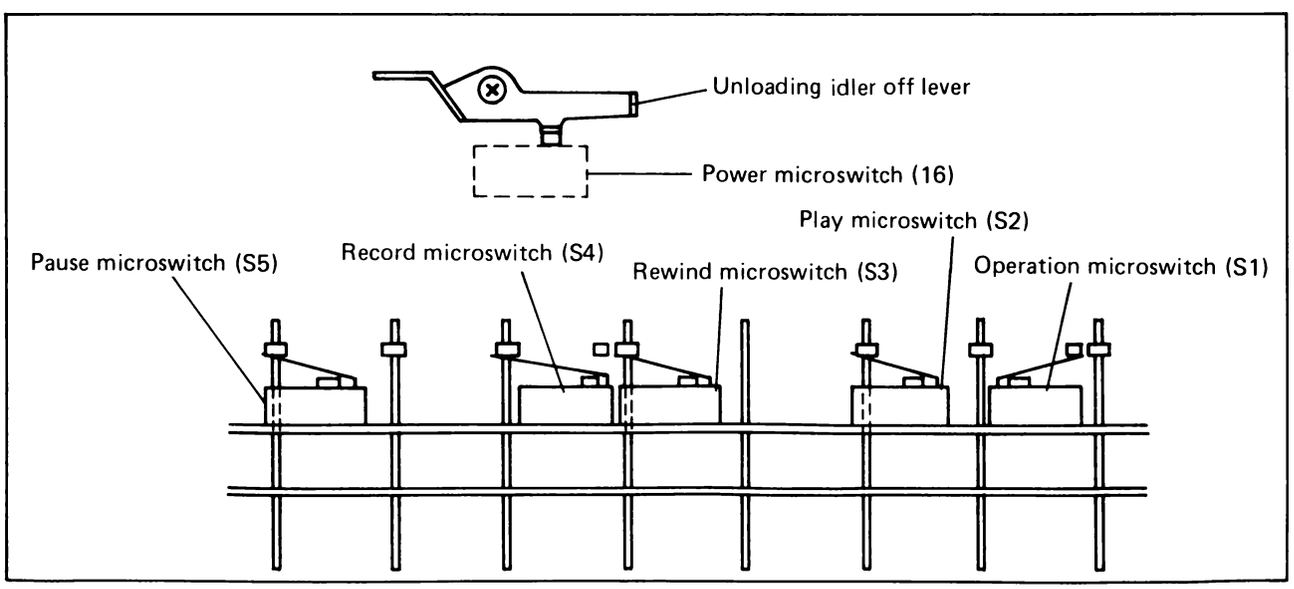



Fig. 5-36

# SECTION 6
# ELECTRONIC ADJUSTMENTS

## 6.1 GENERAL

### 6.1.1 Introduction

The JVC HR-4100E is designed for high reliability. The electrical system has been completely adjusted and carefully inspected before shipment from the factroy. For this reason, the following procedures is needed principally when mechanical parts are replaced and readjustment of the electronic and signal systems is made necessary by such replacement.

If the electrical system should fail, be sure to check all voltages and waveforms before attempting any adjustments. Note that correct operation is achieved only when all circuits are properly adjusted, and therefore, improper adjustment of a single "block" of circuits may disrupt all functions. The best procedure is to locate the cause of trouble first, then begin repair, replacement or adjustment.

This section describes the elecgrical adjustments which may become necessary when printed circuit board or major components have been replaced.

An MOS type IC is employed in this HR-4100E. The MOS IC's are extremely fragile and may be very easily destroyed by improper handling. Always observe the following precautions when servicing this unit.

The MOSIC's are the following:
MSM4011, MSM4023, MSM4069, CD4023UBE, MN6061A, 3SK49Q, UPD4096C, UPD4011C.

1. These ICs are shipped pinned to a conductive foam plastic base. They must not be separated from this base while in storage. If you are using one of several ICs pinned to a common base, remove it from the others by cutting the base. Keep the base attached to the IC until you are ready to mount it. Do NOT substitute any other material for the base.
2. There are several precautions to be observed when soldering the new IC into the circuit. Always use a low wattage soldering iron with an isolation transformer. The work bench should be convered with a conductive metal sheet with the chassis under repair grounded.
3. If it is impossible to obtain an isolation transformer, the soldering iron tip, chassis and technician must all be at a common potential.
4. When the IC is installed and power applied, the case is at +9 V DC. If the case is shorted to ground, the IC may be damaged.

Equipment required:

| | | |
|---|---|---|
| Oscilloscope | | Wide-band, Dual-trace |
| Digital voltmenter | : | HEWLETT-PACKARD Model 3456A/B or equivalent |
| Frequency counter | : | HEWLETT-PACKARD Model 5381A or equivalent |
| Signal generator | : | Color bar, Stairstep |
| Alignment tape | : | JVC MH-2 |

## 6.2 REGULATOR CIRCUIT

### 6.2.1 Check of 20-kHz oscillator

1. Connect a DC voltmeter and a DC power supply to TP-10 on the Capstan/Regulator circuit board as shown in Fig. 6-44.
2. Adjust the DC power supply so that the DC voltage of TP-10 is 12 ± 0.1 volts.
3. Connect an oscilloscope to TP-8 (20-kHz OUT) on the Capstan/Regulator circuit board as shown in Fig. 6-44.
4. Set the unit to Record mode and check that the waveform is as shown in Fig. 6-1.

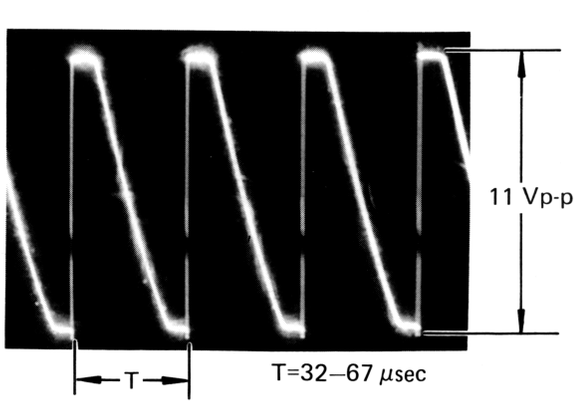



**Fig. 6-1** 20 kHz oscillation waveform

### 6.2.2 Adjustment of 9 volt DC power supply

1. Connect the DC voltmeter and the DC power supply to TP-10 (12 volt) on the Capstan/Regulator circuit board.
2. Set the unit to Record mode and adjust the DC power supply so that the DC voltage of TP-10 is 12 ± 0.1 volts.
3. Then, change to DC voltmeter to TP-9 (9 V REG. OUT) and adjust R53 (9 V Reg) so that the DC voltage of TP-9 is 9 ± 0.1 volts.

### 6.2.3 Adjustment of warning LED sensitivity

1. Conduct this adjustment after completion of subsection 6.2.2.
2. Connect the DC power supply and the DC voltmeter to TP-10 on the Capstan/Regulator circuit board as shown in Fig. 6-44.
3. Set the unit to Record mode and adjust the DC power supply so that the DC voltage of TP-10 is 10.8 volts. In this condition, adjust R59 (Red) to shine the DEW/EMPTY LED (Red) on the panel.
4. Then, change the DC voltage of the DC power supply so that the DC voltage of TP-10 is 11.0 volts. In that time, adjust the R56 (Yellow) to shine the warning LED (yellow) on the panel.

### 6.2.4 Check of dew (moisture) sensor

1. Connect a wire between the pin 14 of IC14 and TP-5 on the Capstan/Regulator circuit board as shown in Fig. 6-44.
2. Depress the PLAY key.
3. In this condition, check that no voltage appears at TP-9 (9 V REG OUT) on the Capstan/Regulator cirecuit board, the unit is not operating, the DEW/EMPTY LED (Red) on the panel flickers.

### 6.2.5 Check of 9-volt delay

1. Connect the DC voltmeter to TP-9 on the Capstan/Regulator circuit board as shown in Fig. 6-44.
2. When each operation key is pressed, 9 volt DC appears at TP-9 after 0.5 second.

## 6.3 ADJUSTMENT OF SERVO CIRCUIT – CAPSTAN SERVO CIRCUIT –

### 6.3.1 Check of 3.58-MHz crystal oscillator output

1. Connect the oscilloscope to TP-3 on the Capstan/Regulator circuit board and set the unit to Record mode

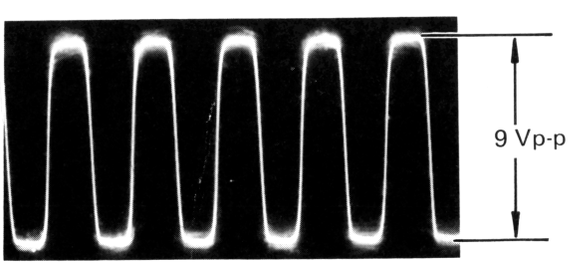



**Fig. 6-2** 3.58 MHz

2. Check the 3.58 MHz waveform is present as shown in Fig. 6-2.

### 6.3.2 Check of capstan Frequency Generator (F G) waveform

1. Connect the oscilloscope to TP-1 on the Capstan/Regulator circuit board and set the unit to Record mode.
2. Check the waveform as shown in Fig. 6-3.

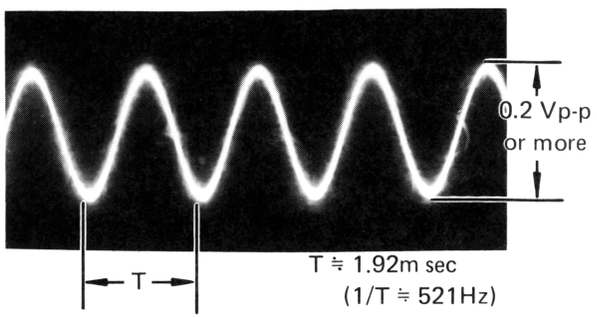



**Fig. 6-3** Capstan FG

### 6.3.3 Adjustment of capstan discriminator

1. Connect the counter to TP-2 on the Capstan/Regulator circuit board.
2. Set the unit to Record mode.
3. Adjust R19 (TAPE SPEED) so that the counter indication is 365 Hz.
4. Connect the oscilloscope to TP-2 and check the waveform level as shown in Fig. 6-4.
5. The final adjustment is performed in subsection 6.3.6.

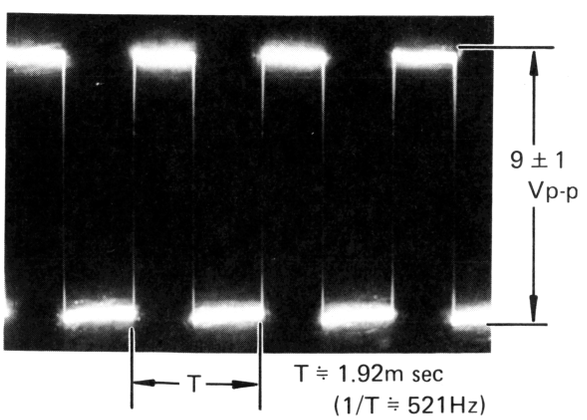



**Fig. 6-4** Capstan discriminator

### 6.3.4 Check of capstan phase error

1. Connect the oscilloscope to TP-4 (CAP. DISCRI OUT) on the Castan/Regulator circuit board.
2. Set the unit to Record mode.

3. Check the pulse level at TP-4 is 5.0 ± 0.5 Vp-p as shown in Fig. 6-5.

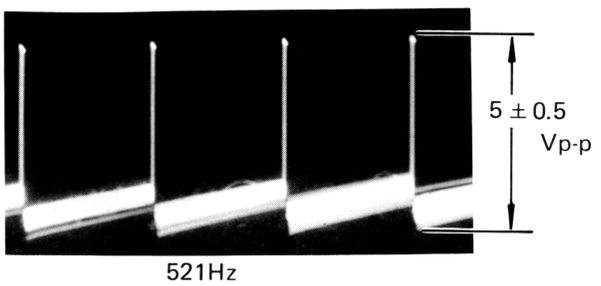



**Fig. 6-5** Capstan phase

### 6.3.5 Check of capstan motor input

1. Connect the oscilloscope to TP-7 (C. MDA IN) on the Capstan/Regulator circuit board.
2. Set the unit to Record mode.
3. Check that the DC voltage is 7.0 ± 1 volt as shown in Fig. 6-6.

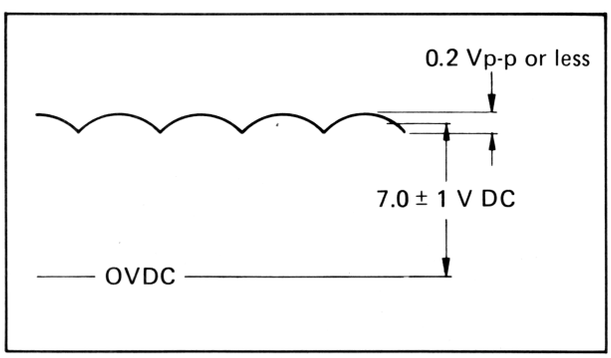



**Fig. 6-6** Capstan motor input

### 6.3.6 Adjustment of tape speed

1. Connect the frequency counter to TP-11 (AUDIO OUT) on the Audio/Servo circuit board.
2. Play back the JVC alignment tape to reproduce the audio 3-kHz signal.
3. Check that the frequency of TP-11 is 3000 Hz ± 0.3% (2991–3009 Hz).
4. If the frequency is out of specification, adjust the R19 (tape speed) on the Capstan/Regulator circuit board so that the frequency of TP-11 is 3000 Hz.

– DRUM SERVO CIRCUIT –

### 6.3.7 Drum sampling waveform check

1. Set the unit to Record mode with video signal as input.
2. Connect the oscilloscope to TP-6 (DRUM SAMPLING) on servo circuit of the Audio/Servo printed circuit board as shown in Fig. 6-45.
3. Check the reference signal position as shown in Fig. 6-7.

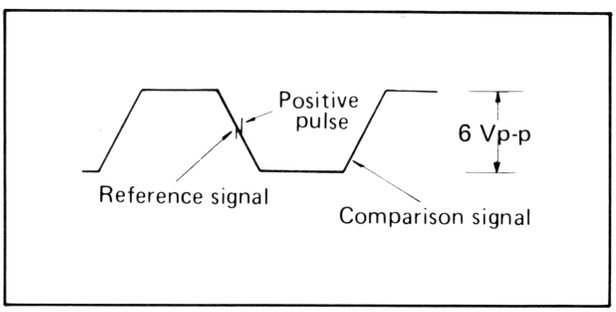



**Fig. 6-7** Drum sampling waveform

4. If no reference signal appears at TP-6, check the following:
   - Input video signal
     Connect the oscilloscope to pin 14 of connector (VIDEO IN) and check the input video signal as shown in Fig. 6-8.
   - Sync separator out
     Connect the oscilloscope to TP-1 (SYNC OUT) and check the level of waveform as shown in Fig. 6-9.

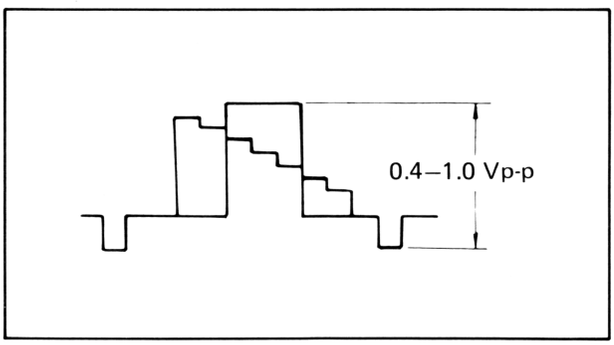



**Fig. 6-8** Input video signal

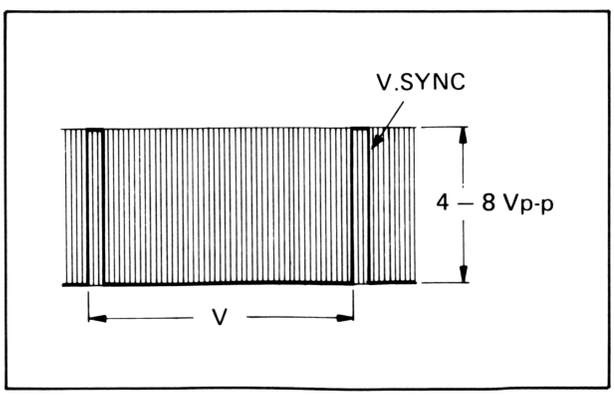



**Fig. 6-9** Sync separator out

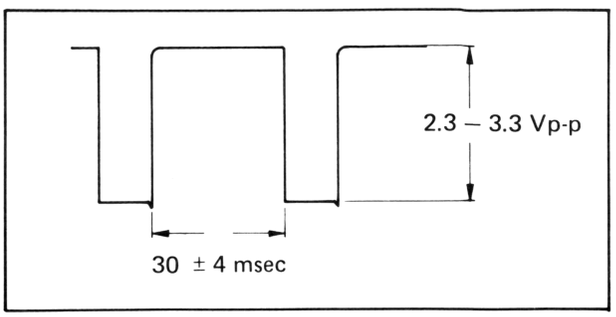



**Fig. 6-10** Recording control signal

- Recording control signal
  Connect the oscilloscope to TP-2 (CTL OUT) and check the waveform as shown in Fig. 6-10.
- Sampling pulse
  Connect the oscilloscope to TP-7 on the servo circuit and check the waveform as shown in Fig. 6-11.

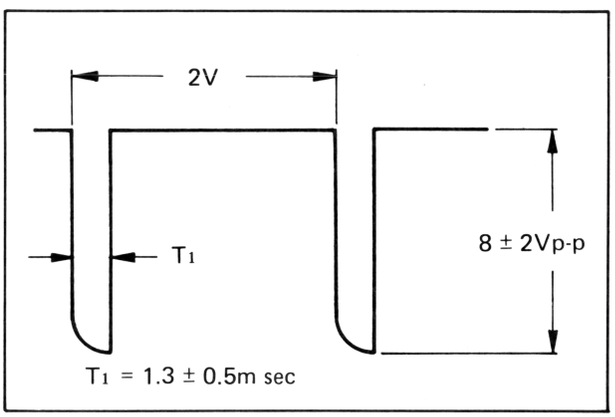



**Fig. 6-11** Sampling pulse waveform

5. If no comparision signal (sawtooth waveform) appears at TP-6, check the following:

   Drum pulse
   Connect the oscilloscope to TP-4 (CH-1 D. PULSE IN) and adjust R21 (D. PULSE LEVEL) so that the negative level of pulse is 0.8 volts peak-to-peak as shown in Fig. 6-12.
   Move the probe to pin 2 of IC3 (CH-2 D. PULSE IN) and check that the negative level of pulse is 0.8 ± 0.3 volts peak-to-peak.

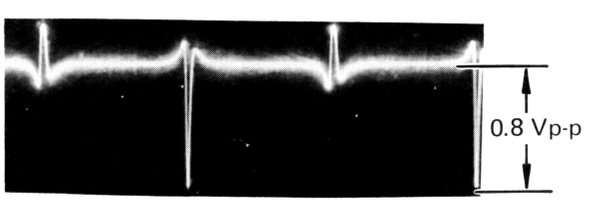



**Fig. 6-12** Drum pulse

- Flip-Flop
  Connect the oscilloscope to TP-3 (Drum F.F. OUT) and check the waveform as shown in Fig. 6-13.

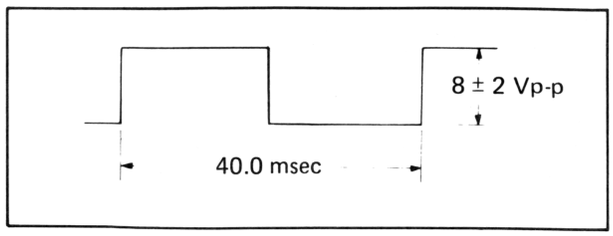



**Fig. 6-13** Drum Flip-Flop

If reference signal is not locked on the comparison signal at TP-6, the drum servo circuit is improperly adjusted or has failed, so that readjustment or repair is needed.

### 6.3.8 Drum frequency generator output

1. Set the unit to Record mode with video signal as input.
2. Connect the oscilloscope to TP-9 (D.F.G AMP. OUT) on the servo circuit and check the waveform as shown in Fig. 6-14.

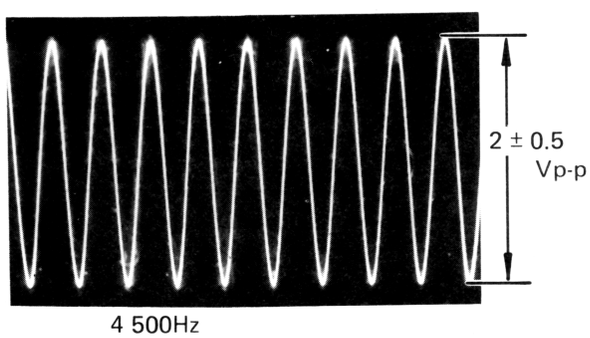



**Fig. 6-14** F.G. Amp output waveform

### 6.3.9 Drum discriminator gain adjustment

1. Set the unit to Record mode with a video signal as input.
2. Connect the oscilloscope to TP-5 (D. Discri) on the servo circuit of A/S printed circuit board.
3. Adjust R30 (D. Discri) so that pulse width is 370 $\mu$s as shown in Fig. 6-15.

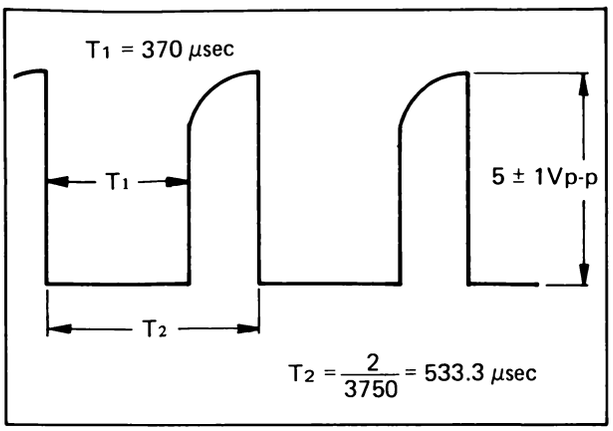



**Fig. 6-15** Drum discriminator

### 6.3.10 Drum free-running adjustment

1. Set the unit to Play mode, then press the PAUSE/STILL key with a video signal or TV program as input.
2. Connect the external sync connector on the oscilloscope to TP-3 (DRUM F.F OUT) of the Audio/Servo circuit board.
3. Connect the oscilloscope to TP-1 (VIDEO IN) on the Y/C printed circuit board and adjust R62 (Still) on the servo circuit so that the video signal is synchronized with the external sync signal.

### 6.3.11 Drum motor input check

1. Set the unit to Record mode with the video signal as input.
2. After the servo circuit locked, connect the oscillscope to TP-10 (D. MDA IN) on the Audio/Servo circuit board.
3. Verify that the DC level of TP-10 is within the range; 4–6 volts.
4. Set the unit to Play mode. Then press the PAUSE key and verify the AC ripple of TP-10 as shown in Fig. 6-16. If the AC ripple is more than 0.5 volts peak-to-peak on TP-10, the drum motor will have to be replaced.

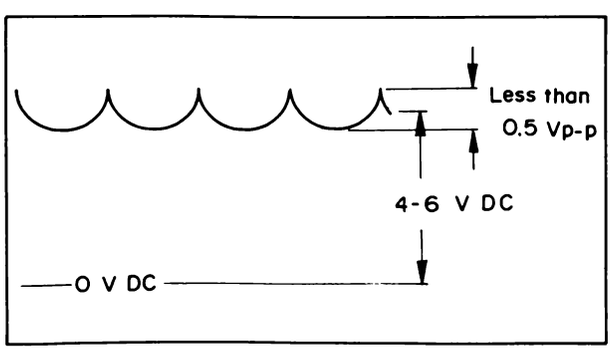



**Fig. 6-16** AC ripple of drum motor input

### 6.3.12 Playback switching point adjustment

1. Play back the JVC alignment tape MH-2 to reproduce the stair-step segment.
2. Set the oscilloscope externally from TP-3 (DRUM F.F. OUT) of the Audio/Servo circuit board.
3. Set the trigger slope of the scope to minus "–".
4. Connect the oscilloscope to TP-1 (SYNC OUT) on the Audio/Servo circuit board, and adjust R24 (CH-1 SW PHASE) so that the trigger point (switching point) is 5.5 to 7.5 H before the vertical sync signal as shown in Fig. 6-17.

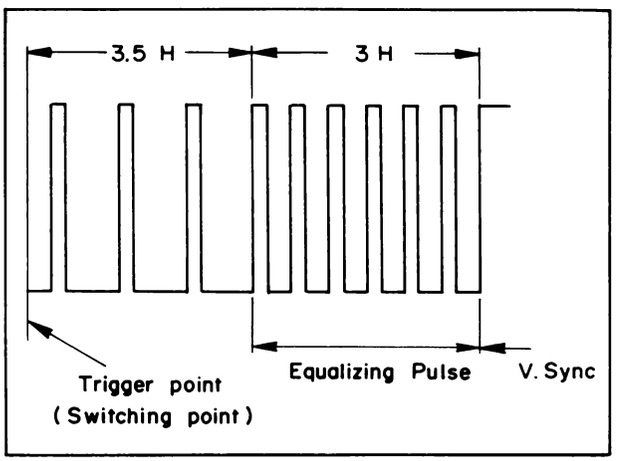



**Fig. 6-17** Switching point adjustment

5. Set the trigger slope of the oscilloscope to plus "+" and adjust R26 (CH-2 SW PHASE) on the Audio/Servo circuit board so that the trigger point (switching point) becomes the same value as obtained above step 4.

### 6.3.13 Recording switching point adjustment

1. Set the unit to the Record mode with the video signal as input.
2. Set the oscilloscope externally from TP-3 (DRUM F.F. OUT) on the Audio/Servo circuit board.
3. Set the trigger slope of the oscilloscope to minus "–".
4. Connect the oscilloscope to TP-1 (SYNC OUT) on the Audio/Servo circuit board.
5. Adjust R28 (SW point) on Audio/Servo circuit board so that the trigger point (switching point) is 6.5 ± 1 H prior to the vertical sync signal. Refer to Fig. 6-17.

### 6.3.14 Tracking preset adjustment

1. Record, then play back, the video signal.
2. Connect the oscilloscope to TP-2 (CTL OUT) on the Audio/Servo circuit board.

3. Turn the TRACKING control to fully counter-clockwise position (click-stop position) and adjust R14 (PRESET) so that a clear picture is obtained.
4. Check that the waveform at Tp-2 is observed as shown in Fig. 6-18.

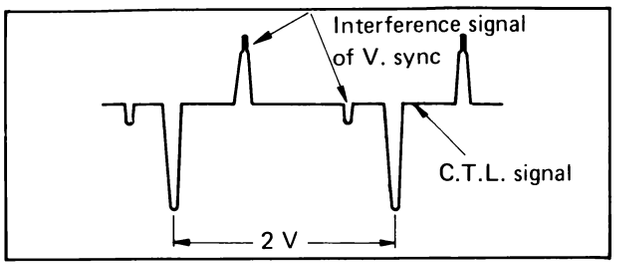



**Fig. 6-18** Waveform of control pulse

### 6.3.15 Tracking control check

1. Play back the JVC alignment tape MH-2 to reproduce the stair-step segment.
2. Turn the TRACKING control to the fully counter-clockwise position (FIX. position) and check that the picture is the same as the best picture obtained by turning the TRACKING control manually.
3. If a noisy picture (as compared with manual position) is observed, adjust the position of the Audio/Control head.
4. Connect the oscilloscope to TP-7 (P.B. FM OUT) on the Pre/Record Amplifier circuit board.
5. Check that the level difference between the Fixed position's level and maximum level obtained manually is less than 1 dB.

### 6.3.16 Playback control signal check

1. Play back the JVC alignment tape to reproduce the stair-step segment.
2. Connect the oscilloscope to TP-2 (CTL OUT) on servo circuit of the Audio/Servo printed circuit board.
3. Verify the negative pulse of the control signal as shown in Fig. 6-19.
4. Record then play back the video signal, and verify the pulse level as same as step 3.

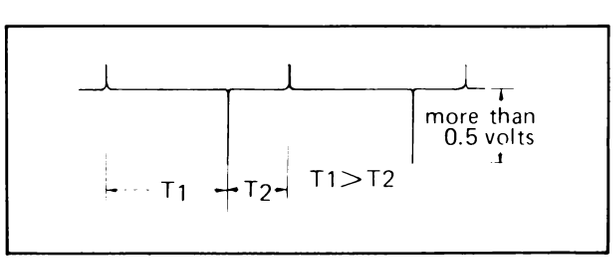



**Fig. 6-19** Control signal

### 6.3.17 Servo lock-in time check

1. Connect the oscilloscope to TP-6 (D. SAMPLING) on the Audio/Servo circuit board.
2. Record, then play back a color signal, checking for a period of eight seconds or less, from the time the power supply is turned on, (the PLAY key is pressed) to the time a sampling pulse locks on the ramp of the trpzoidal waveform as described in subsection 6.3.7.
3. If servo lock-in time is out of specification, set the unit to Record mode, check the samping pulse moving direction on the trapzoidal waveform till it locks-up.
4. If the sampling pulse at TP-6 is moving in direction from right to left, readjust R30 (D DISCRI) so that the pulse width is within 370–385 μseconds at TP-5.
5. If the sampling pulse moving direction is from left to right at TP-6, readjust R30 so that the pulse width is within 355–370 μseconds at TP-5.
6. Repeat steps 2 and 5 above until the best result is obtained.
7. Recheck subsection 6.3.10, and then repeat the adjustment.

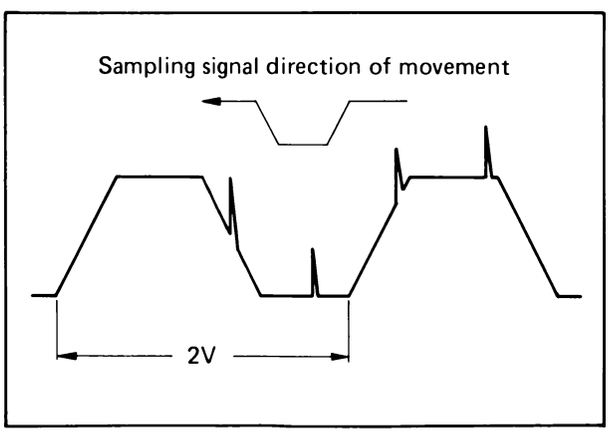



**Fig. 6-20** Servo lock-in

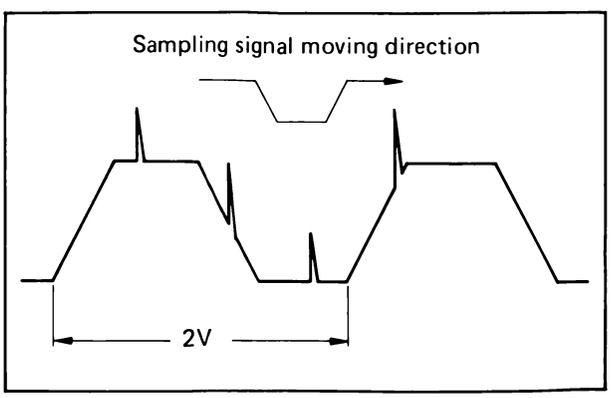



**Fig. 6-21** Servo lock-in

## 6.4 LUMINANCE AND CHROMINANCE SIGNAL RECORDING SYSTEM

Refer to Fig. 6-46 "Luminance/Chrominance (Y/C) Amplifier printed circuit board and Fig. 6-47" Pre/ Record Amplifier printed circuit board.

### 6.4.1 Adjustment of video head resonance and Q (quality factor)

NOTE: This adjustment is generally unnecessary except when replacing the video head assembly.

1. Turn R33 (CH-1 HEAD Q) fully counterclockwise and R34 (CH-2 HEAD Q) fully clockwise.
2. Connect the oscilloscope to TP-4 (CH-1 FM OUT) on the pre-amplifier circuit of the Pre/ Record Amplifier printed circuit board.
3. Play back the JVC alignment tape to reproduce the RF segment.

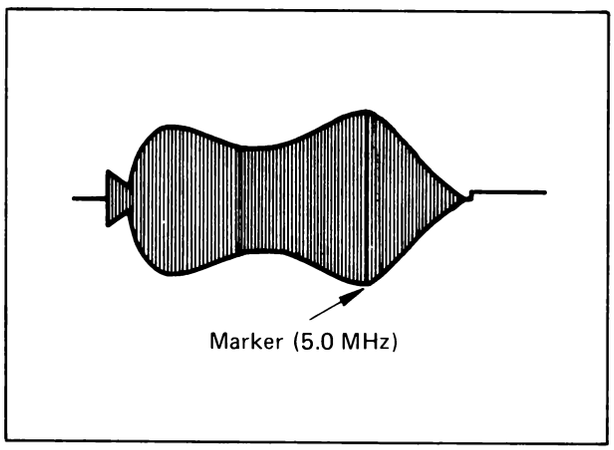



**Fig. 6-22** RF signal

4. Adjust C18 (CH-1 RESON) so that the peak resonance at marker (5.0 M) becomes as shown in Fig. 6-22.
5. Connect the oscilloscope to TP-5 (CH-2 FM OUT) on the pre-amplifier circuit.
6. Adjust C19 (CH-2 RESON) in the same manner as above (CH-1 adjustment).
7. Record a monoscope or equivalent signal and then play back.
8. If there is flicker or black fringing around bright objects, adjust R33 or R34.

### 6.4.2 FM channel balance adjustment

1. Play back the JVC alignment tape to reproduce the color bar segment.
2. Connect the oscilloscope to TP-7 (P.B. FM OUT) on the pre-amplifier of the Pre/Record Amplifier printed circuit board.
3. Adjust the tracking control knob so that the amplitude of the waveform is maximum.
4. Adjust R48 (FM CH. BALANCE) so that the amplitude of (a) and (b) in Fig. 6-22 are equal to each other.

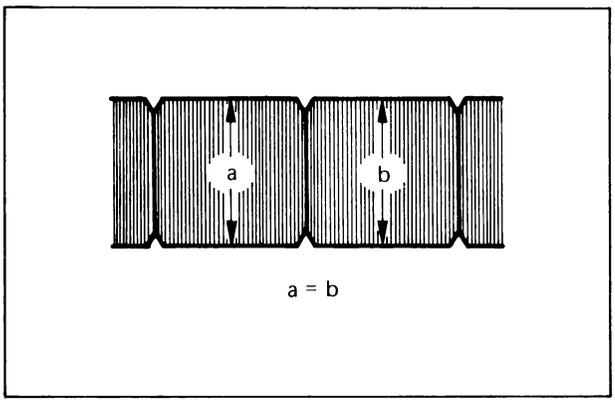



**Fig. 6-23** FM channel balance

### 6.4.3 Drop-out compensator (D.O.C.) adjustment

1. Set the unit to Record mode with a video signal as input and then play it back.
2. Connect the oscilloscope to TP-7 (PB FM OUT) on the Pre/Record circuit board.

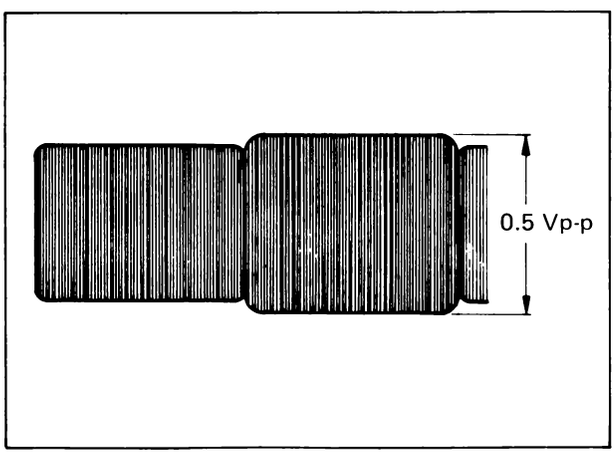



**Fig. 6-24** DOC input level

3. Adjust R55 (PB FM LEVEL) so that the maximum amplitude of the waveform at TP-7 is 0.5 volts peak-to-peak.

NOTE: Recheck the above steps after performing the subsection 6.4.9 "FM record level adjustment".

### 6.4.4 Limiter and carrier balance adjustment;

1. Play back the JVC alignment tape to reproduce the color bar segment.
2. Connect the oscilloscope to TP-2 (VIDEO OUT) on the luminance circuit.
3. Adjust R81 (LIMITER BAL-1) so that the carrier leakage at sync tip of the waveform of TP-2 is minimum.

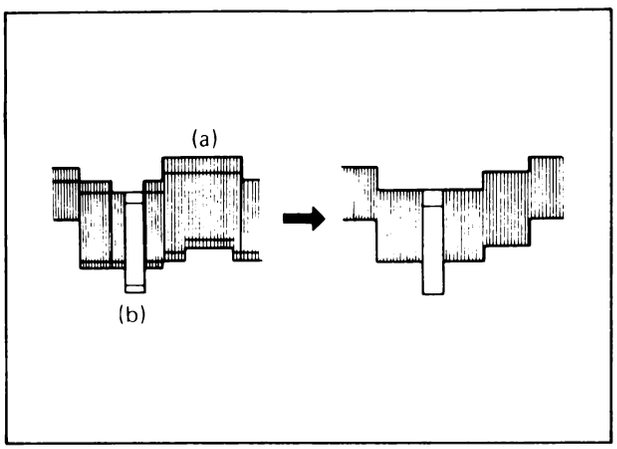



**Fig. 6-25** Limiter and Carrier balance

4. Move the oscilloscope probe to TP-8 (DEMOD. OUT) on the luminance circuit.
5. Adjust R98 (LIMITERBAI-2)and R89 (CARRIER BAL.) so that the peak white (a) and sync tip (b) becomes a single line as shown in Fig. 6-25.

### 6.4.5 Playback video level adjustment

1. Play back the JVC alignment tape to reproduce the color bar segment.
2. Connect the oscilloscope to TP-2 (VIDEO OUT) on the luminance circuit.
3 Adjust R37 (P.B. OUT LEVEL) so that the level of TP-2 is 2.0 Vp-p as shown in Fig. 6-26.

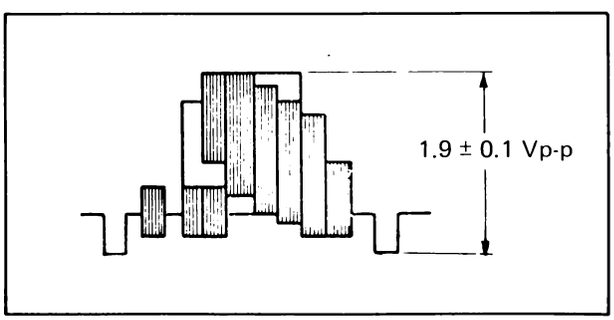



**Fig. 6-26** Video output (without load)

### 6.4.6 Carrier and deviation adjustment

A. With high frequency sine-wave generator

1. Set the unit to Record mode with a stair-step signal as input.
2. Connect the oscilloscope to TP-2 (VIDEO OUT) and TP-9 (REC FM OUT) on the luminance circuit, and set the oscilloscope to "A ± B" mode.
3. Connect a high-frequency sine-wave generator output to TP-9 (REC FM OUT) on the luminance circuit.
4. Before adjustment, turn R12 (WHITE CLIP) and R26 (DARK CLIP) to fully counterclockwise position, so that the signal is not limited.
5. Set the frequency of high-frequency sine-wave generator to 3.8 MHz, and adjust R20 (CARRIER SET) so that the waveform observed at the oscilloscope shows a zero beat at the bottom of the waveform as shown in Fig. 6-27.
6. Set the frequency of high-frequency sine-wave generator to 4.8 MHz, and adjust R36 (DEVIATION), so that the waveform observed on the oscilloscope shows a zero beat at the top of the video signal as shown in Fig. 6-28.
7. Then adjust the subsection 6.4.7 "White and dark clip adjustment".

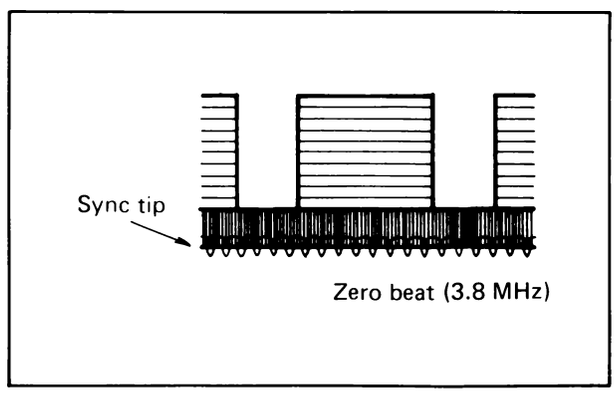



**Fig. 6-27** Carrier and deviation adjustment – A

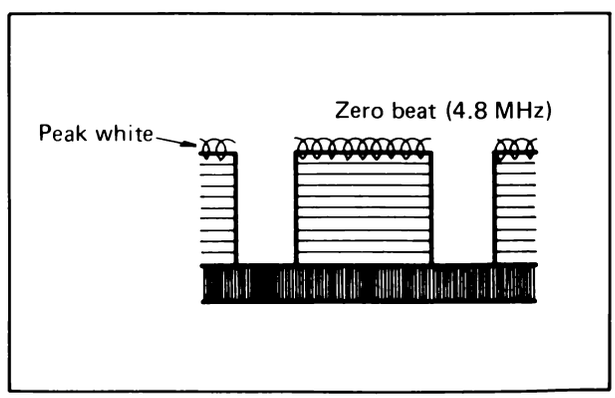



**Fig. 6-28** Carrier and deviation adjustment – B

B. With DC power supply and frequency counter

1. Connect the DC power supply to TP-4 (PRE-EMPHA. OUT) on the luminance circuit.
2. Connect the frequency counter to TP-9 (REC. FM OUT) on the luminance circuit.
3. Before adjustment, turn R12 (WHITE CLIP) and R26 (DARK CLIP) fully counterclockwise.
4. Set the unit to Record mode with no video signal as input.
5. Connect the oscilloscope to TP-4 on the luminance circuit.
6. Adjust the DC voltage of the power supply so that the frequency of TP-9 is 3.8 MHz and measure the DC voltage of TP-4 with the oscilloscope (approximately 4.0 volts DC).
7. The adjust the DC voltage of the power supply so that the frequency of TP-9 is 4.8 MHz, and measure the DC voltage of TP-4 with the oscilloscope (approximately 5.4 volts DC).
8. Remove the DC power supply and the frequency counter from the test points on the luminace circuit.
9. Supply color bar (or stair-step) signal as input keeping the Record mode.
10. Adjust R20 (CARRIER SET) so that the DC sync tip level of the waveform at TP-4 is the same DC voltage as measured in step 5.
11. Next adjust R36 (DEVIATION) so that the DC peak white level of the waveform at TP-4 is the same DC voltage as measured in step 6.

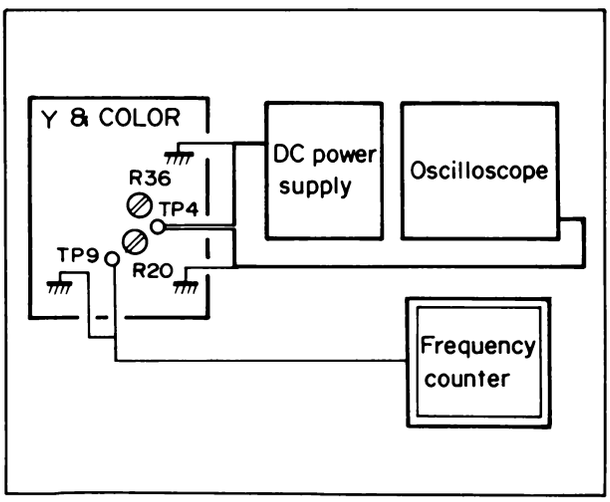



**Fig. 6-29** Carrier and deviation adjustment setup

12. Then adjust the subsection 6.4.7 "White and dark clip adjustment".

### 6.4.7 White and dark clip adjustment

1. Set the unit to Record mode with color bar signal as input.
2. Connect the oscilloscope to TP-4 (PRE-EMPHA. OUT) on the luminance circuit of the Y/C (Luminance/Chrominance signal) printed circuit board.
3. Adjust R12 (WHITE CLIP), so that the amplitude ratio of transient "spikes" with white clip becomes as shown in Fig. 6-30.
4. Adjust R26 (DARK CLIP), so that the amplitude ratio of the transient "spikes" with dark clip becomes as shown in Fig. 6-30.

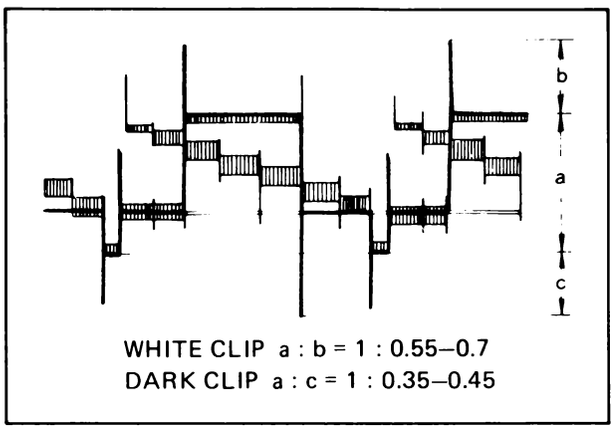



**Fig. 6-30** White and dark clip adjustment

### 6.4.8 Adjustment of carrier leak and carrier balance

NOTE: The following adjustment is generally unnecessary except when replacing the FM modulator unit.

1. Set the unit to Record mode with the color bar signal as input.
2. Connect the oscilloscope to TP-9 (REC. FM OUT) on the luminance circuit of the Y/C printed circuit board.
3. Adjust C4 (SYMMETRY) and R1 (CARRIER LEAK) on the FM modulator unit so that the modulator waveform is symmetrical to the center and minimum.

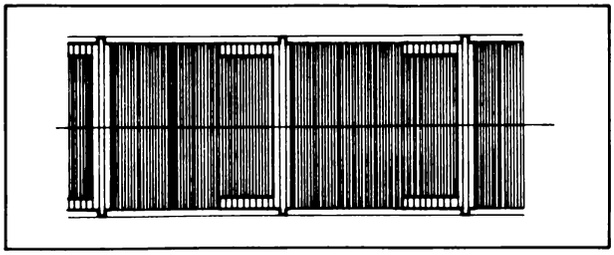


**Fig. 6-31** Modulator output

### 6.4.9 FM record level adjustment

1. Set the unit to Record mode with color bar signal as input.
2. Connect the oscilloscope to TP-1 (REC OUT) on the record amplifier circuit of the Pre/Record Amplifier printed circuit board.
3. Adjust R1 (FM REC LEVEL), so that the level of TP-1 is 3.0 Vp-p as shown in Fig. 6-32.

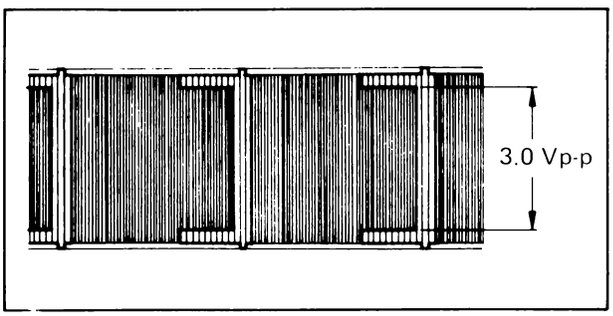



**Fig. 6-32** FM record level

### 6.4.10 Video output level (E-to-E) adjustment

1. Set the unit to Record mode with color bar signal as input.
2. Connect the oscilloscope to TP-2 (VIDEO OUT) on the luminance circuit of the Y/C (Luminance/ Chrominance amplifier) printed circuit board.
3 Adjust R66 (E-E LEVEL), so that the level of TP-2 is 2.0 Vp-p (with no load).

### 6.4.11 Aperture adjustment

1. Connect a wire between the pin 3 of IC13 and ground.
2. Play back JVC alignment tape to reproduce the color bar segment.
3. Connect the oscilloscope to TP-2 (VIDEO OUT) on the luminance circuit.

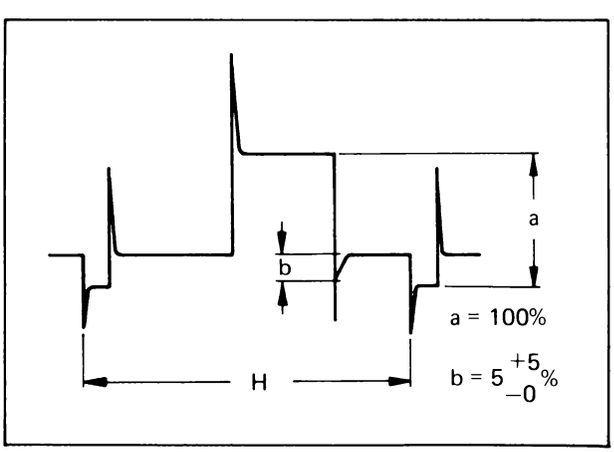



**Fig. 6-33** Aperture adjustment

4. Adjust R48 (APERTURE) so that the amplitude of (a) and (b) becomes as shown in Fig. 6-33.
5. After adjustment, record then play back the video signal, and verify the picture on the monitor.

NOTE: After adjustment, the wire must be removed.

## 6.5 COLOR SIGNAL SYSTEM ADJUSTMENT

Refor Fig. 6-46 "Luminance/Chrominance (Y/C) amplifier printed circuit board", and Fig. 6-47 "Pre/ Record Amplifier printed circuit board".

### 6.5.1 Oscillating frequency (4.43 MHz) adjustment

1. Connect the frequency counter to TP-215 (4.43 MHz X'TAL OSC. OUT) on the Y/C circuit board.
2. Play back the JVC alignment tape to reproduce the color bar segment.
3. Adjust C295 (4.43 MHz OSC.) so that the frequency of TP-215 is 4.433619 MHz ± 40 Hz.

### 6.5.2 Variable crystal oscillator (4.43 MHz) adjustment

1. Connect a wire between TP-222 and ground.
2. Set the unit to Record mode with color bar signal as input.
3. Connect the frequency counter to TP-219 on the Y/C circuit board.
4. Adjust R249 (V.X.O.) so that the frequency of TP-219 is 5.060571 ± 30 Hz.

### 6.5.3 AFC adjustment

A:

1. Set the unit to Record mode with the color bar signal as input.

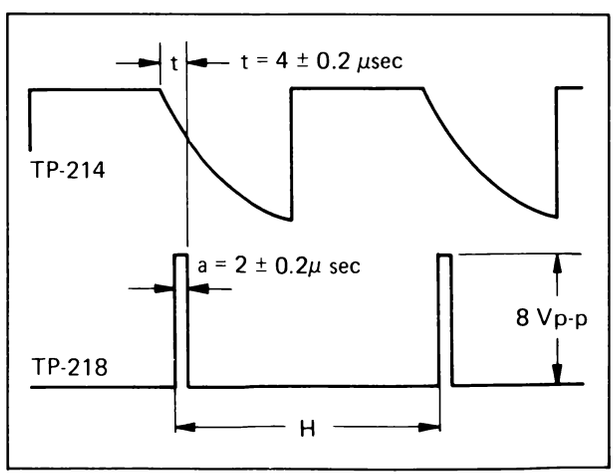



**Fig. 6-34** AFC adjustment – A

2. Set the oscilloscope externally from TP-1 (sync out) on the Audio/Servo circuit board.
3. Connect the CH-1 of the oscilloscope to TP-218 (Fh REFERENCE OUT) and CH-2 to TP-214(AFC SAWTOOTH) on the Y/C circuit board. Select the CHOP mode.
4. Adjust R301 (PULSE WIDTH) so that width of "a" is 2 $\mu$s as shown in Fig. 6-34.
5. Adjust R311 (AFC) so that width of "t" is 4 $\mu$s as shown in Fig. 6-34.

B: Dual-trace oscilloscope is not available, preform the following adjustment.

1. Set the unit to Record mode with the video signal as input.
2. Connect the external sync connector on the oscilloscope to TP-218 (Fh REFERENCE OUT) on the Y/C circuit board.
3. Set the osccilloscope to negative trigger position.
4. Connect the oscilloscope to TP-214 (AFC SAWTOOTH) on the Y/C circuit board.
5. Adjust R311 (AFC) so that the pulse width of TP-214 is 60 $\mu$sec from the trigger point as shown in Fig. 6-35.

NOTE: Subsection 6.5.1, 6.5.2, 5.3, describe very important adjustments for the color A.P.C and A.F.C. circuit, so check these section first, then perform the following adjustment.

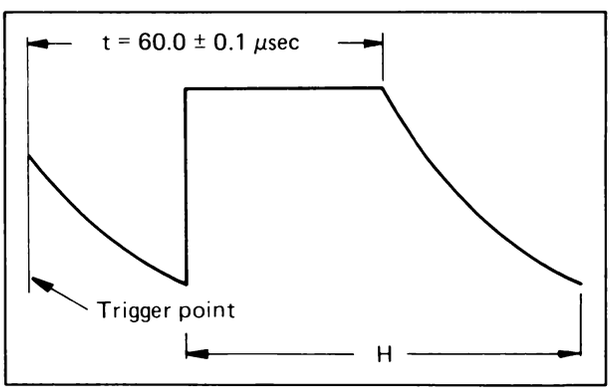



**Fig. 6-35** AFC adjustment – B

### 6.5.4 Playback color channel balance adjustment

1. Play back the JVC alignment tape to reproduce the color bar segment.
2. Connect the oscilloscope to TP-202 (ACC INPUT) on the Y/C circuit board.
3. Adjust the levels to be equal by using R49 (P.B. COLOR CH. BALANCE) on the Pre/Rec amplifier circuit board as shown in Fig. 6-36.

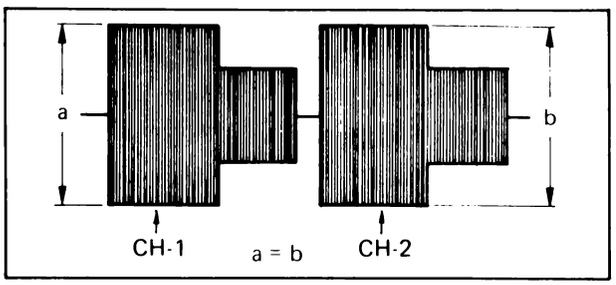



**Fig. 6-36** Playback color channel balance

### 6.5.5 Playback color level adjustment

1. Play back the JVC alignment tape to reproduce the color bar segment.
2. Connect the oscilloscope to TP-202 (ACC INPUT) on the Y/C circuit board.
3. Adjust R52 (P.B. COLOR LEVEL) on the Pre/Rec circuit board so that the level of TP-202 is 0.2 Vp-p as shown in Fig. 6-37.

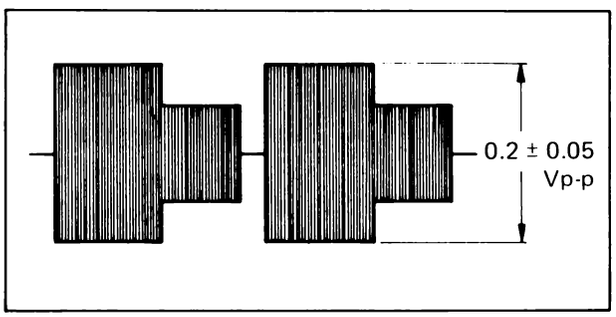



**Fig. 6-37** Playback color level

### 6.5.6 Main converter balance adjustment

1. Play back the JVC alignment tape to reproduce the color bar segment.
2. Connect the oscilloscope to TP-206 on the color circuit of the Luminance/Chrominance printed circuit board.
3. Adjust R216 (CONV. BAL.) so that the carrier leak of TP-206 minimum, as shown in Fig. 6-38.

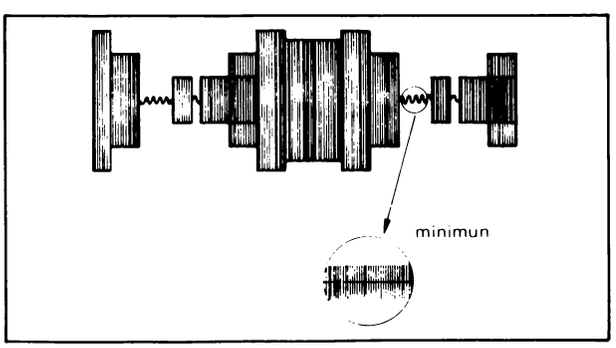



**Fig. 6-38** Main converter balance adjustment

### 6.5.7 ACC output level adjustment

1. Conduct the adjustment after completion of Item 6 . 5 . 5.
2. Connect the oscilloscope to TP-203 (ACC OUT) on the Y/C printed circuit board.
3. Play back the JVC alignment tape to reproduce the color bar segment.
4. Adjust R335 (ACC OUT LEVEL) so that the level of color signal is 0.3 ± 0.04 Vp-p.

### 6.5.8 Burst limiter check

1. Connect the oscilloscope to TP-207 on the Y/C printed circuit board.
2. Set the unit to Record mode with color bar signal as input.
3. Verify that the level of color burst signal is within the range of 1.2—1.5 Vp-p.

### 6.5.9 Playback color output level adjustment

1. Play back the JVC alignment tape to reproduce the color bar segment.
2. Connect the oscilloscope to TP-2 (VIDEO OUT) on the Y/C (Luminance/Chrominance) printed circuit board.
3. Adjust R215 (COLOR LEVEL) so that the level of color burst signal is 0.54 Vp-p (with no load) as shown in Fig. 6-39.

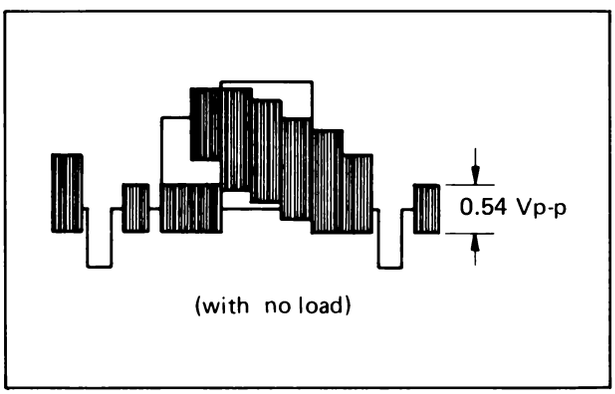



**Fig. 6-39** Playback color output level adjustment

### 6.5.10 Color recording level and channel balance adjustment

1. Set the unit to Record mode with the color bar signal as input.
2. Connect the oscilloscope to TP-202 (ACC INPUT) on the Y/C circuit board.
3. Adjust R24 (REC COLOR BALANCE) on the Pre/Rec circuit board during Record mode. Then perform playback, so that the color levels to be equal.
4. Adjust R2 (REC COLOR LEVEL) on the Record amplifier circuit during Record mode, then play back it, so that the level of TP-202 is 0.22 Vp-p as shown in Fig. 6-40.
5. Repeat steps 3 and 4 above two or three times.

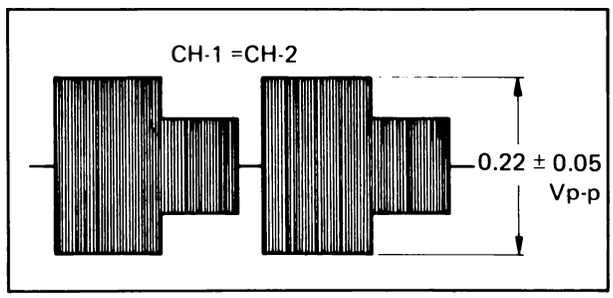



**Fig. 6-40** Color level

### 6.5.11 FM channel balance check

1. Set the unit to Record mode with video signal as input, then play it back.
2. Connect the oscilloscope to TP-7 (P.B. FM OUT) on the Pre/Rec amplifier circuit board.
3. Check the level difference between the channels is within 3 dB as shown in Fig. 6-41.
4. Recheck the subsection 6.4.3 "Drop-out compensator (D.O.C.) adjustment".

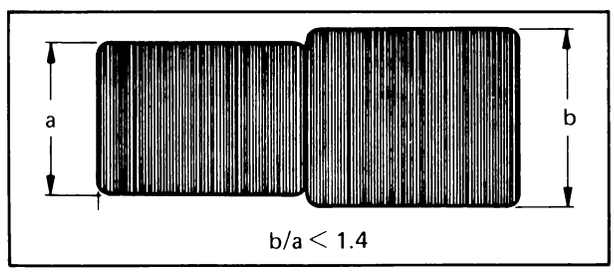



**Fig. 6-41** FM channel balance

### 6.5.12 Adjustment of record color killer

1. Prepare the two kinds of attenuators.
2. Set the unit to Record mode with color bar signal as input.
3. Connect the oscilloscope to TP-211.
4. Connect an attenuator (47 $\mu$ + 120 $\Omega$) between TP-201 and ground as shown in Fig. 6-42.
5. Adjust R28 (REC. COL. KILLER) so that the DC potential of TP-211 is high (approx. 8 V DC).
6. Next change a resistor of attenuator from 120 ohms to 150 ohms, and make sure that the DC voltage at TP-211 is zero.
7. Repeat steps 4) to 6) above until the good result is obtained.

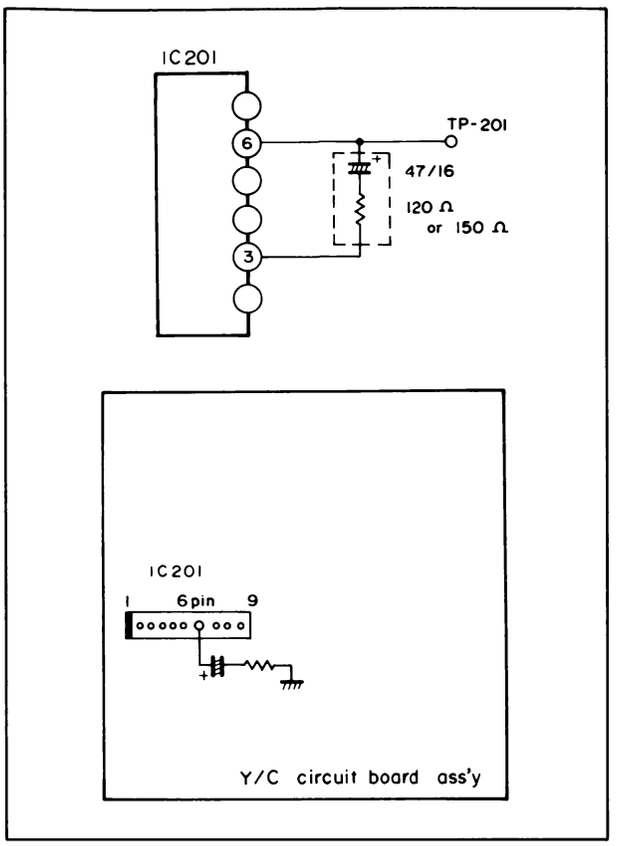



**Fig. 6-42** REC. COL. Killer setup

## 6.6 AUDIO AMPLIFIER CIRCUIT ADJUSTMENT

Refer to Fig. 6-46 "Audio/Servo amplifier printed circuit board".

### 6.6.1 Playback level adjustment;

1. Play back the JVC alignment tape MH-2 to reproduce the color bar segment.
2. Connect the oscilloscope to TP-11 (AUDIO OUT) on the audio amplifier circuit of the Audio/Servo amplifier circuit board.
3. Adjust R90 (P. B. LEVEL) so that the level of TP-11 is 2.2 Vp-p (0 dB) as shown in Fig. 6-43.

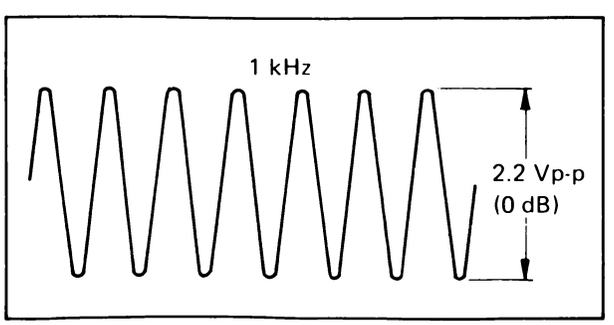



**Fig. 6-43** Playback level

### 6.6.2 E-to-E level adjustment

1. Set the unit to Record mode with 1 kHz sine-waveform, 0.22 Vp-p (−20 dB) as input.
2. Connect the oscilloscope to TP-11 (AUDIO OUT) on the audio amplifier circuit.
3. Adjust R76 (E-E LEVEL) so that the level of TP-11 is 2.2 Vp-p (0 dB).

### 6.6.3 Bias level adjustment

1. Set the unit to Record mode.
2. Connect the oscilloscope to TP-12 (AUDIO REC OUT) on the Audio/Servo circuit board.
3. Adjust R119 (BAIAS LEVEL) so that the level of TP-12 70 Vp-p and also, check the level of TR-13 (ERASE HEAD IN) is more than 60 Vp-p as shown in Fig. 6-44.

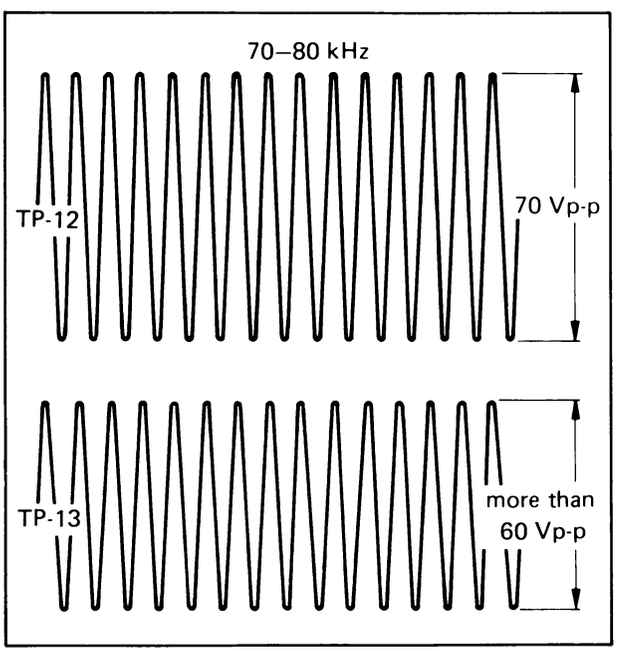



**Fig. 6-44** Bias level

### 6.6.4 Bias leak adjustment

1. set the unit to Record mode with no signal as input.
2. Connect the oscilloscope to TP-11 (AUDIO OUT) on the audio circuit.
3. Adjust L3 so that the leak of bias on TP-11 is minimum (less than 0.2 Vp-p).

### 6.6.5 Record level adjustment

1. Set the unit to Record mode with 1 kHz sine-waveform signal, 0.22 Vp-p (−20 dB) as input.
2. Connect the oscilloscope to TP-11 (AUDIO OUT) on the audio amplifier circuit.

3. Adjust R99 (REC LEVEL) during Record mode, tnen play it back so that the level of TP-11 is 2.2 Vp-p at the Playback mode.

### 6.6.6 Adjustment of recording equalizer

NOTE: This adjustment should be performed after completion of subections 6.6.1 to 6.6.5.

1. Set the unit to Record mode with 7-kHz sine-waveform signal, 0.07 Vp-p as input.
2. Connect the oscilloscope to TP-11 (AUDIO OUT) on the Audio/Servo circuit board.
3. Adjust R101 (Rec EQ.) during Record mode, then play it back so that the level of TP-11 is within 1.6 −3.1 Vp-p at the Playback mode.
4. If an unsatisfactory result is obtained, unsolder R84 located on the printed pattern side. Then readjust R101.

CAP/REG board

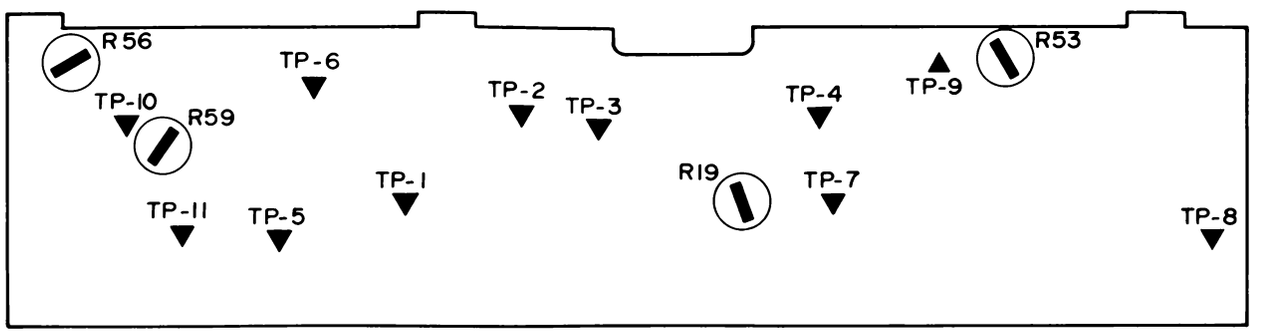



Fig. 6-45

AUDIO/SERVO board

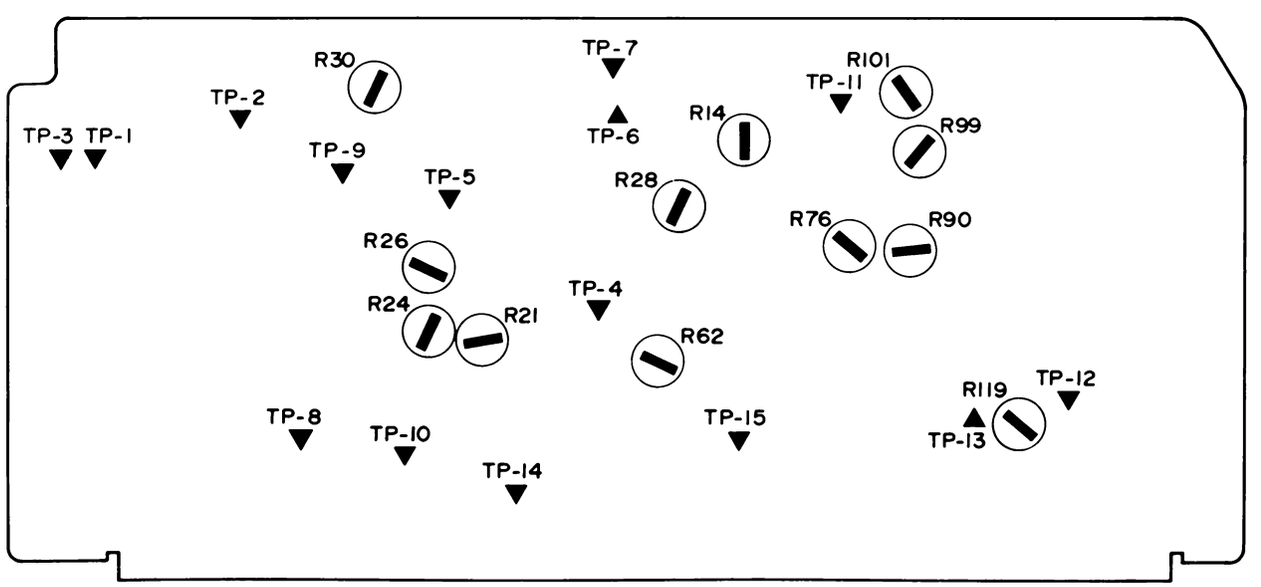



Fig. 6-46

Y/COLOR board

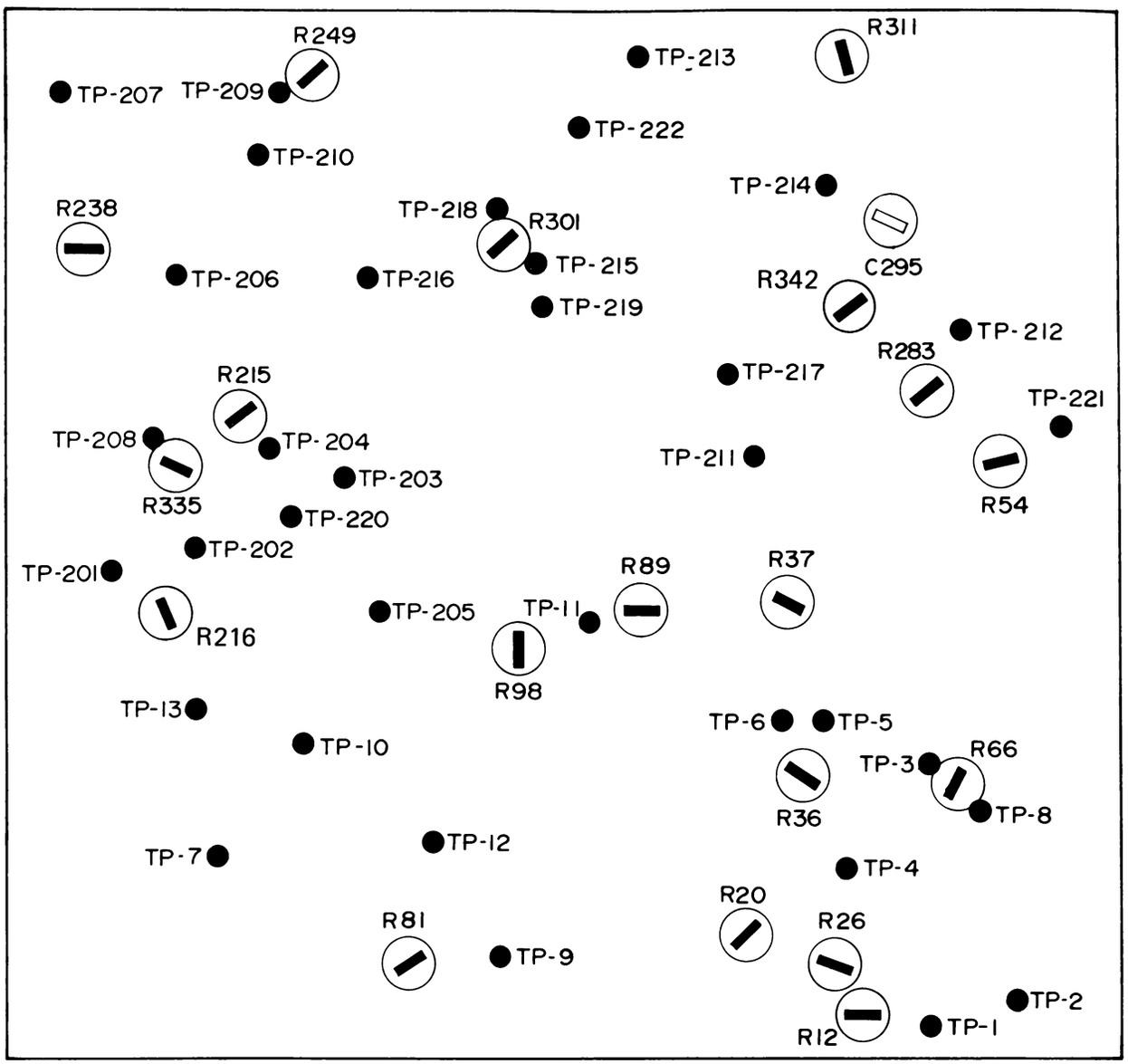



Fig. 6-47

PRE/REC board

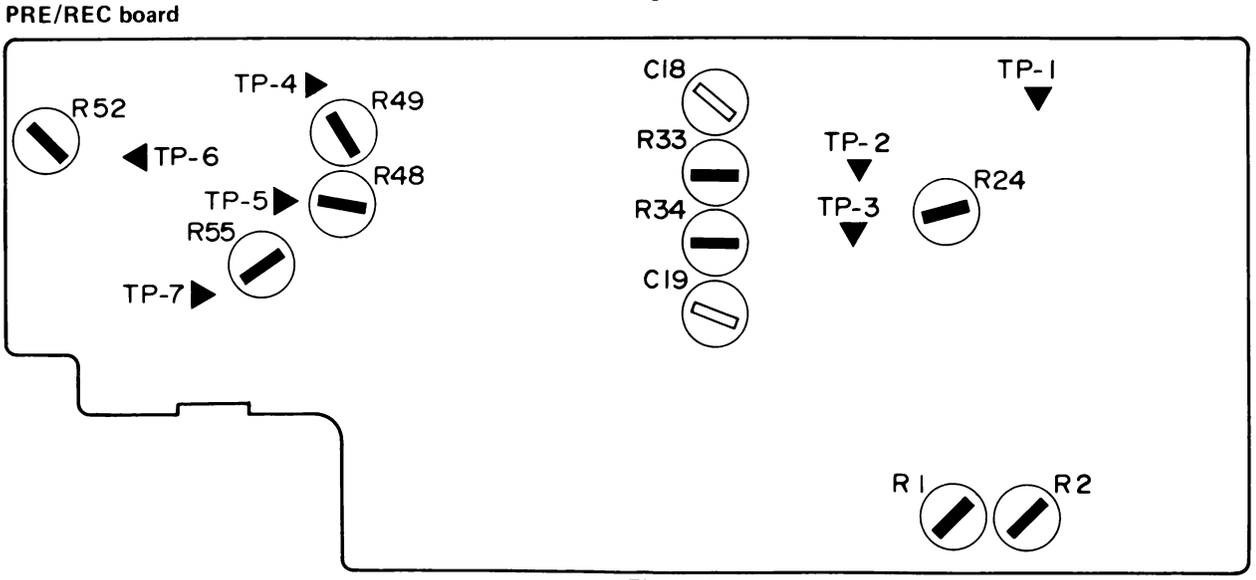
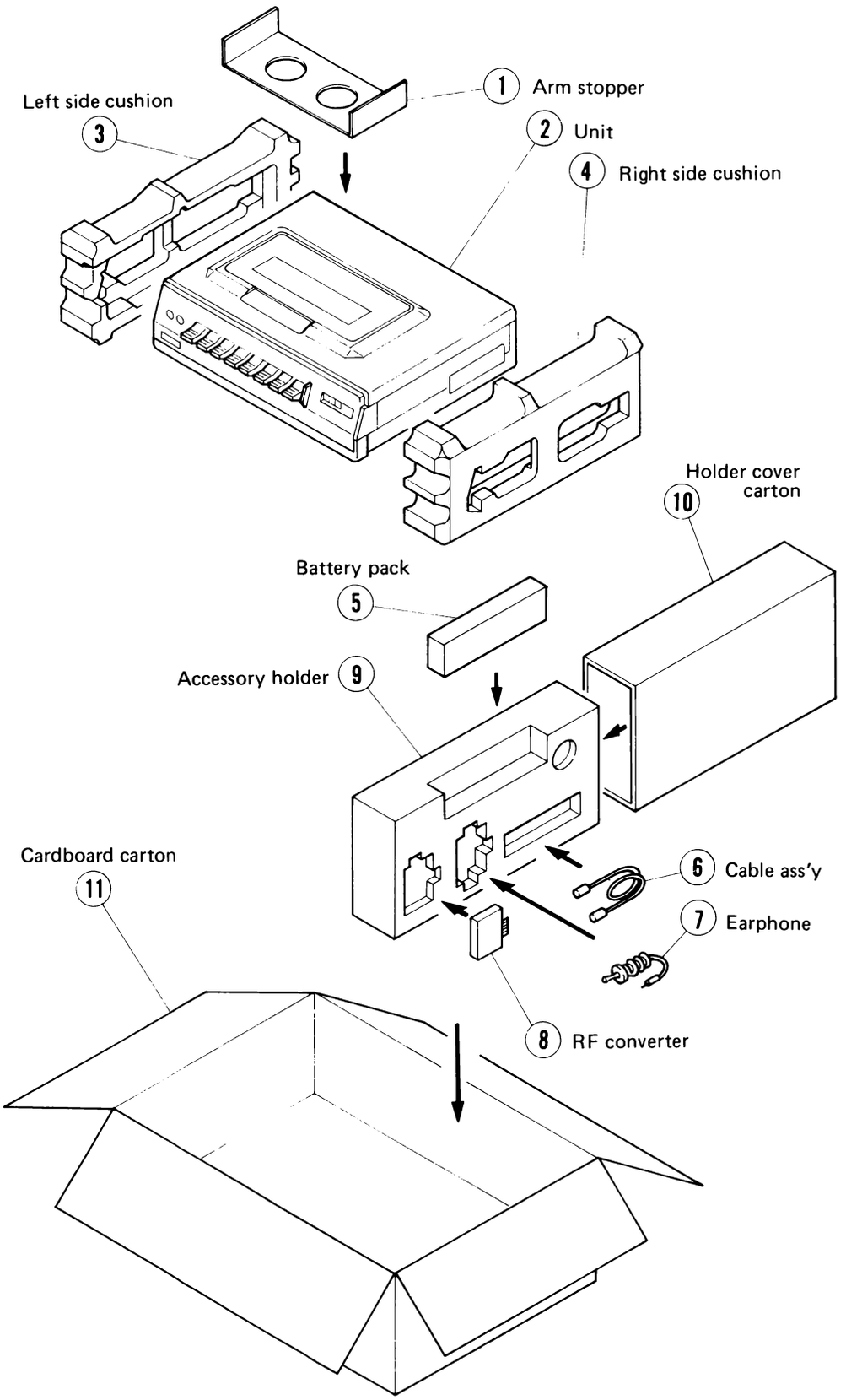



Fig. 6-48

# SECTION 7
# REPACKING



# SECTION 8
# TROUBLESHOOTING GUIDE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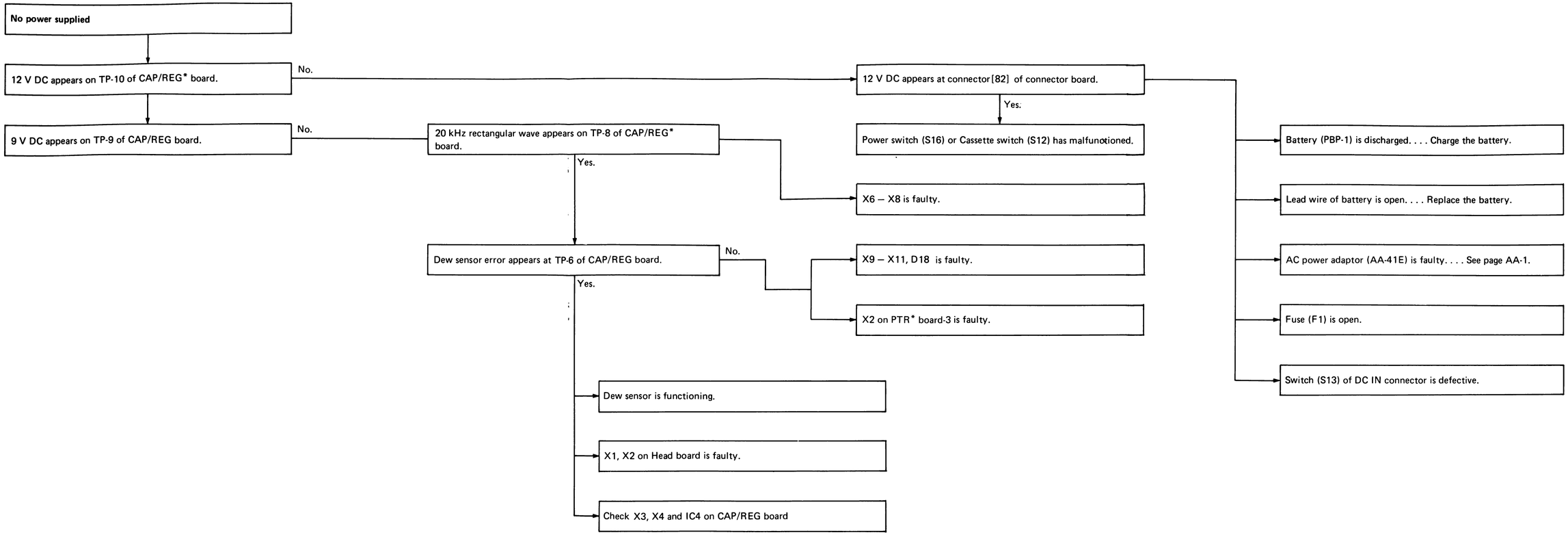
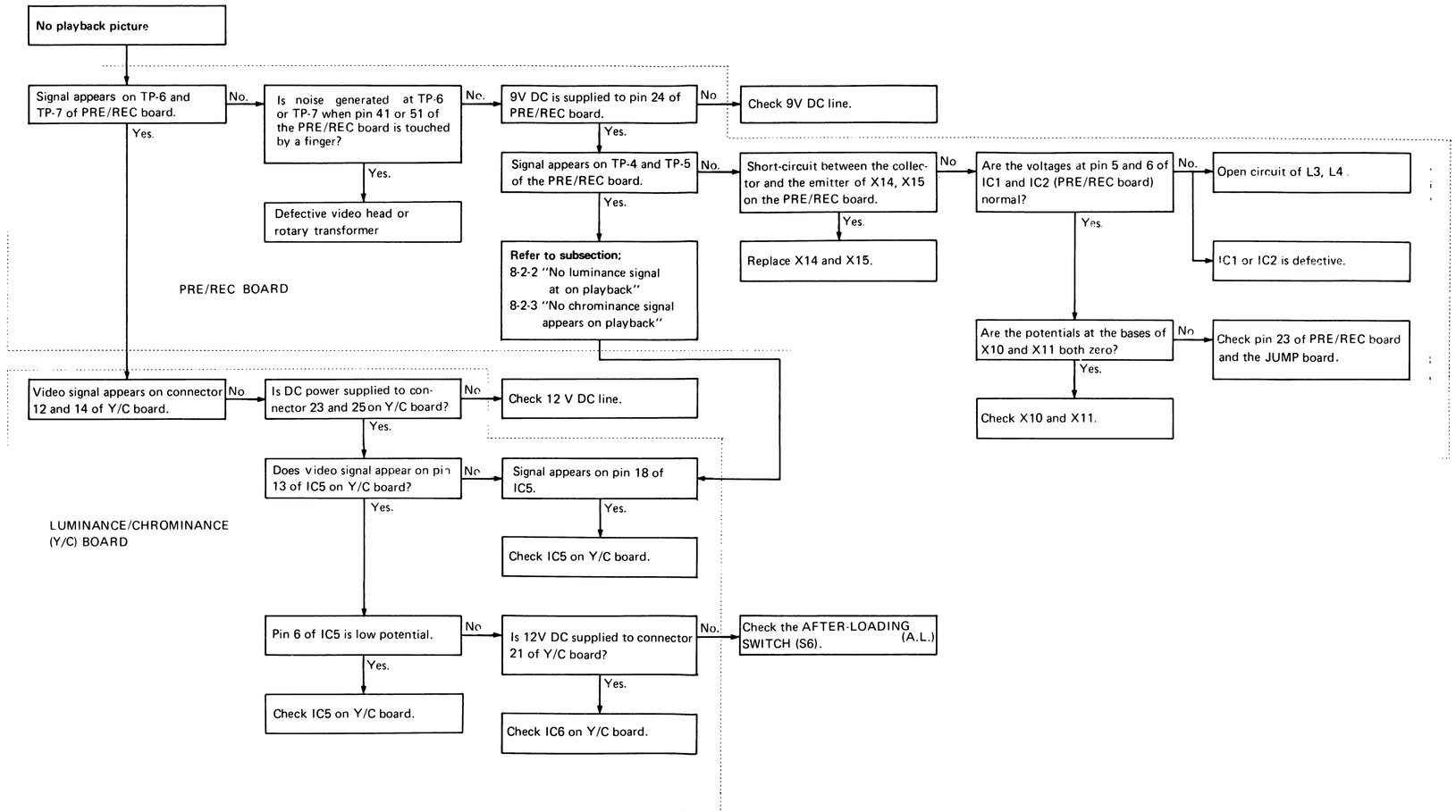
## 8.1 REGULATOR CIRCUIT


No power supplied
12 V DC appears on TP-10 of CAP/REG* board.
No.
12 V DC appears at connector [82] of connector board.
Yes.
9 V DC appears on TP-9 of CAP/REG board.
No.
20 kHz rectangular wave appears on TP-8 of CAP/REG* board.
Yes.
Power switch (S16) or Cassette switch (S12) has malfunctioned.
X6 – X8 is faulty.
Dew sensor error appears at TP-6 of CAP/REG board.
No.
Yes.
X9 – X11, D18 is faulty.
X2 on PTR* board-3 is faulty.
Dew sensor is functioning.
X1, X2 on Head board is faulty.
Check X3, X4 and IC4 on CAP/REG board
Battery (PBP-1) is discharged. . . . Charge the battery.
Lead wire of battery is open. . . . Replace the battery.
AC power adaptor (AA-41E) is faulty. . . . See page AA-1.
Fuse (F1) is open.
Switch (S13) of DC IN connector is defective.

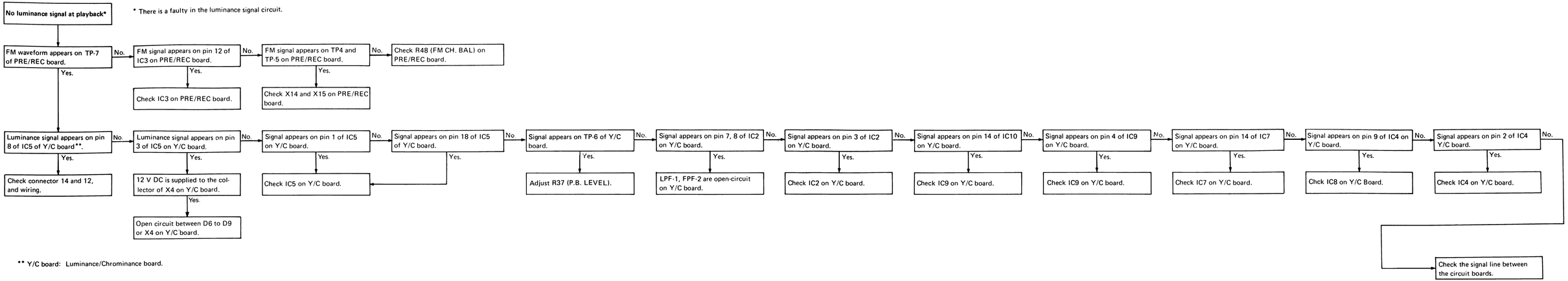
* CAP/REG . . . CAPSTAN/REGULATOR
PTR . . . . . Power transistor

## 8-2 VIDEO SIGNAL PLAYBACK SYSTEM

### 8-2-1 Playback with alignment tape

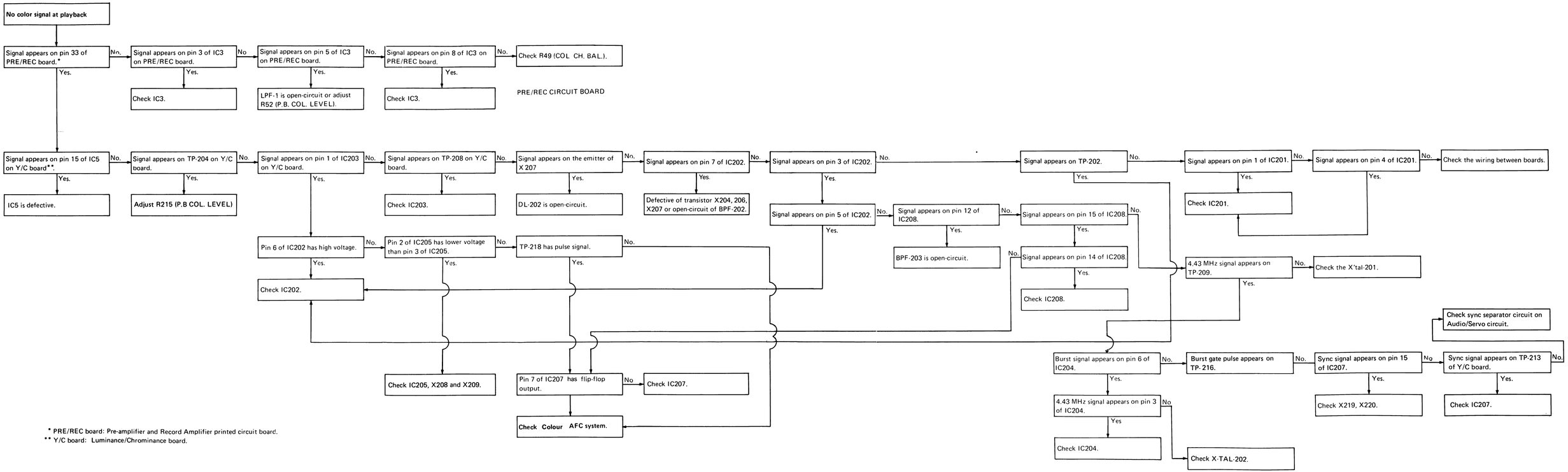

No playback picture
Signal appears on TP-6 and TP-7 of PRE/REC board.
No.
Yes.
Is noise generated at TP-6 or TP-7 when pin 41 or 51 of the PRE/REC board is touched by a finger?
No.
Yes.
Defective video head or rotary transformer
9V DC is supplied to pin 24 of PRE/REC board.
No
Yes.
Check 9V DC line.
Signal appears on TP-4 and TP-5 of the PRE/REC board.
No.
Yes.
Short-circuit between the collector and the emitter of X14, X15 on the PRE/REC board.
No
Yes.
Replace X14 and X15.
Are the voltages at pin 5 and 6 of IC1 and IC2 (PRE/REC board) normal?
No.
Yes.
Open circuit of L3, L4.
IC1 or IC2 is defective.
Refer to subsection;
8-2-2 "No luminance signal at on playback"
8-2-3 "No chrominance signal appears on playback"
PRE/REC BOARD
Are the potentials at the bases of X10 and X11 both zero?
No
Yes.
Check pin 23 of PRE/REC board and the JUMP board.
Check X10 and X11.
Video signal appears on connector 12 and 14 of Y/C board.
No
Is DC power supplied to connector 23 and 25 on Y/C board?
No
Yes.
Check 12 V DC line.
Does video signal appear on pin 13 of IC5 on Y/C board?
No
Yes.
Signal appears on pin 18 of IC5.
Yes.
Check IC5 on Y/C board.
LUMINANCE/CHROMINANCE (Y/C) BOARD
Pin 6 of IC5 is low potential.
No
Yes.
Check IC5 on Y/C board.
Is 12V DC supplied to connector 21 of Y/C board?
No.
Yes.
Check IC6 on Y/C board.
Check the AFTER-LOADING SWITCH (S6). (A.L.)

**8-2-2 No luminance signal at playback**


No luminance signal at playback*
* There is a faulty in the luminance signal circuit.
FM waveform appears on TP-7 of PRE/REC board.
No.
FM signal appears on pin 12 of IC3 on PRE/REC board.
No.
FM signal appears on TP4 and TP-5 on PRE/REC board.
No.
Check R48 (FM CH. BAL) on PRE/REC board.
Yes.
Check IC3 on PRE/REC board.
Check X14 and X15 on PRE/REC board.
Yes.
Luminance signal appears on pin 8 of IC5 of Y/C board**.
No.
Luminance signal appears on pin 3 of IC5 on Y/C board.
No.
Signal appears on pin 1 of IC5 on Y/C board.
No.
Signal appears on pin 18 of IC5 of Y/C board.
No.
Signal appears on TP-6 of Y/C board.
No.
Signal appears on pin 7, 8 of IC2 on Y/C board.
No.
Signal appears on pin 3 of IC2 on Y/C board.
No.
Signal appears on pin 14 of IC10 on Y/C board.
No.
Signal appears on pin 4 of IC9 on Y/C board.
No.
Signal appears on pin 14 of IC7 on Y/C board.
No.
Signal appears on pin 9 of IC4 on Y/C board.
No.
Signal appears on pin 2 of IC4 Y/C board.
No.
Yes.
Check connector 14 and 12, and wiring.
12 V DC is supplied to the collector of X4 on Y/C board.
Check IC5 on Y/C board.
Adjust R37 (P.B. LEVEL).
LPF-1, FPF-2 are open-circuit on Y/C board.
Check IC2 on Y/C board.
Check IC9 on Y/C board.
Check IC9 on Y/C board.
Check IC7 on Y/C board.
Chck IC8 on Y/C Board.
Check IC4 on Y/C board.
Open circuit between D6 to D9 or X4 on Y/C board.
Check the signal line between the circuit boards.

** Y/C board: Luminance/Chrominance board.

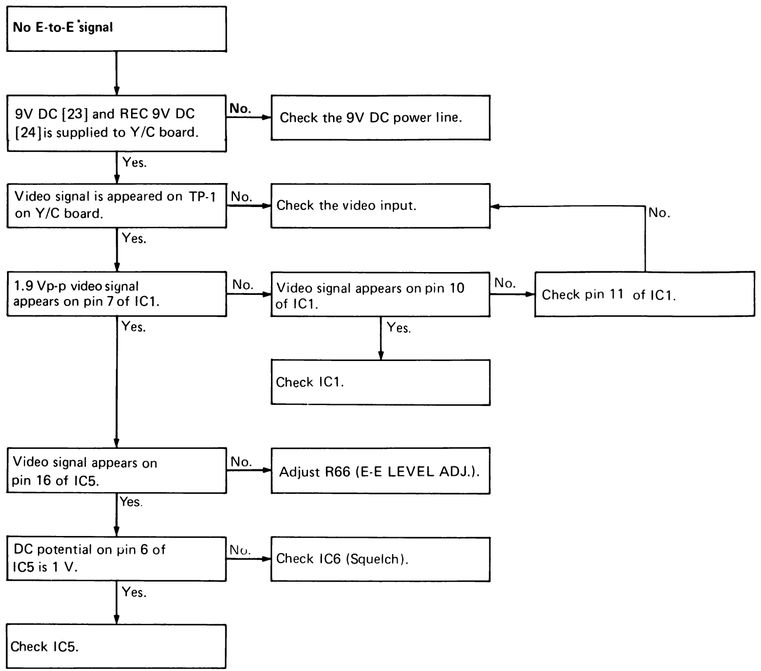
8-2-3 No color signal on playback


No color signal at playback
Signal appears on pin 33 of PRE/REC board.*
No.
Yes.
Signal appears on pin 3 of IC3 on PRE/REC board.
Check IC3.
Signal appears on pin 5 of IC3 on PRE/REC board.
LPF-1 is open-circuit or adjust R52 (P.B. COL. LEVEL).
Signal appears on pin 8 of IC3 on PRE/REC board.
Check IC3.
Check R49 (COL CH. BAL.).
PRE/REC CIRCUIT BOARD
Signal appears on pin 15 of IC5 on Y/C board**.
IC5 is defective.
Signal appears on TP-204 on Y/C board.
Adjust R215 (P.B COL. LEVEL)
Signal appears on pin 1 of IC203 on Y/C board.
Signal appears on TP-208 on Y/C board.
Check IC203.
Signal appears on the emitter of X 207
DL-202 is open-circuit.
Signal appears on pin 7 of IC202.
Defective of transistor X204, 206, X207 or open-circuit of BPF-202.
Signal appears on pin 3 of IC202.
Signal appears on pin 5 of IC202.
Signal appears on pin 12 of IC208.
BPF-203 is open-circuit.
Signal appears on pin 15 of IC208.
Signal appears on pin 14 of IC208.
Check IC208.
Signal appears on TP-202.
Signal appears on pin 1 of IC201.
Check IC201.
Signal appears on pin 4 of IC201.
Check the wiring between boards.
Pin 6 of IC202 has high voltage.
Check IC202.
Pin 2 of IC205 has lower voltage than pin 3 of IC205.
TP-218 has pulse signal.
Check IC205, X208 and X209.
Pin 7 of IC207 has flip-flop output.
Check IC207.
Check Colour AFC system.
4.43 MHz signal appears on TP-209.
Check the X'tal-201.
Check sync separator circuit on Audio/Servo circuit.
Burst signal appears on pin 6 of IC204.
4.43 MHz signal appears on pin 3 of IC204.
Check IC204.
Check X-TAL-202.
Burst gate pulse appears on TP-216.
Sync signal appears on pin 15 of IC207.
Check X219, X220.
Sync signal appears on TP-213 of Y/C board.
Check IC207.

* PRE/REC board: Pre-amplifier and Record Amplifier printed circuit board.
** Y/C board: Luminance/Chrominance board.

## 8-3 VIDEO RECORDING SYSTEM

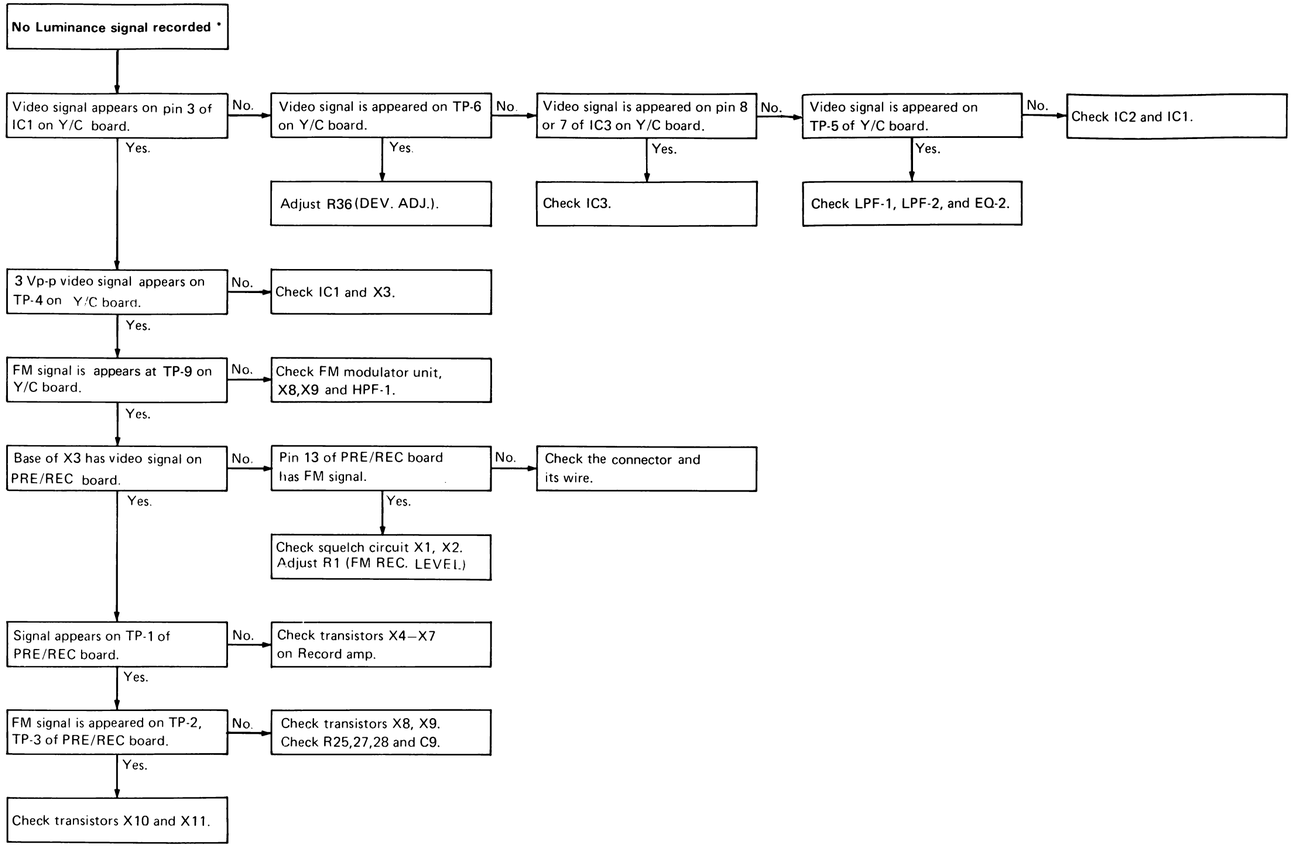
### 8-3-1 E-to-E signal line




NOTE: Presupposing that all the circuits used in common with the playback system are normal.

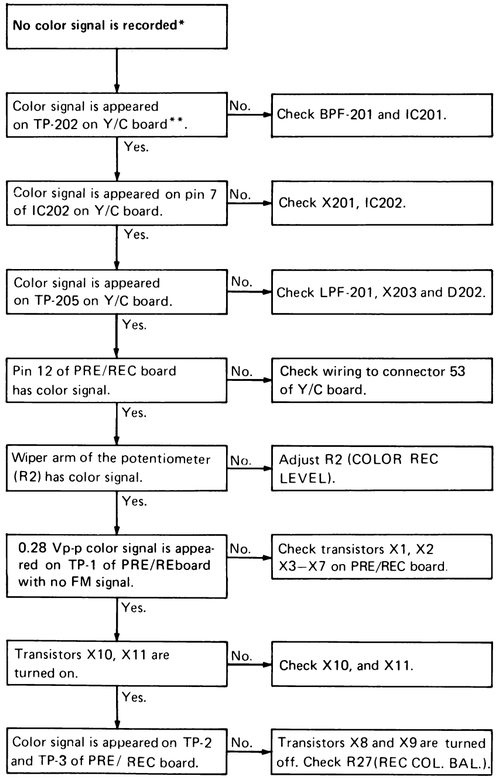
* E to E : Electronic to Electronic.

### 8-3-2 Luminance signal — No record


No Luminance signal recorded *
Video signal appears on pin 3 of IC1 on Y/C board.
No.
Video signal is appeared on TP-6 on Y/C board.
No.
Video signal is appeared on pin 8 or 7 of IC3 on Y/C board.
No.
Video signal is appeared on TP-5 of Y/C board.
No.
Check IC2 and IC1.
Yes.
Yes.
Yes.
Yes.
Adjust R36 (DEV. ADJ.).
Check IC3.
Check LPF-1, LPF-2, and EQ-2.
3 Vp-p video signal appears on TP-4 on Y/C board.
No.
Check IC1 and X3.
Yes.
FM signal is appears at TP-9 on Y/C board.
No.
Check FM modulator unit, X8,X9 and HPF-1.
Yes.
Base of X3 has video signal on PRE/REC board.
No.
Pin 13 of PRE/REC board has FM signal.
No.
Check the connector and its wire.
Yes.
Yes.
Check squelch circuit X1, X2. Adjust R1 (FM REC. LEVEL)
Signal appears on TP-1 of PRE/REC board.
No.
Check transistors X4–X7 on Record amp.
Yes.
FM signal is appeared on TP-2, TP-3 of PRE/REC board.
No.
Check transistors X8, X9. Check R25,27,28 and C9.
Yes.
Check transistors X10 and X11.

*The following excludes the circuit of E-to-E system.
**Y/C : Luminance and color printed circuit board.

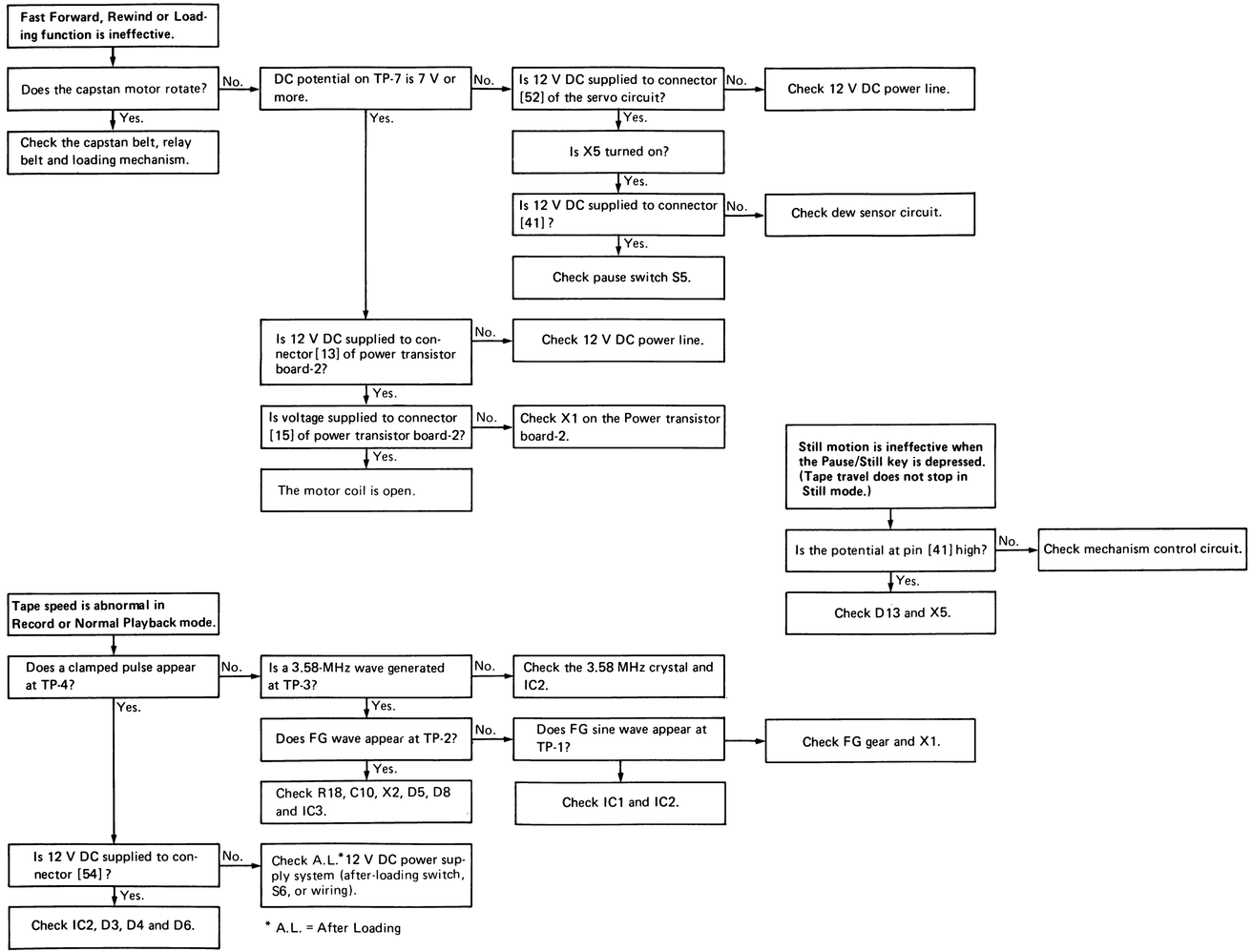
### 8-3-3 Color signal — No record


No color signal is recorded*
Color signal is appeared on TP-202 on Y/C board**.
No.
Check BPF-201 and IC201.
Yes.
Color signal is appeared on pin 7 of IC202 on Y/C board.
No.
Check X201, IC202.
Yes.
Color signal is appeared on TP-205 on Y/C board.
No.
Check LPF-201, X203 and D202.
Yes.
Pin 12 of PRE/REC board has color signal.
No.
Check wiring to connector 53 of Y/C board.
Yes.
Wiper arm of the potentiometer (R2) has color signal.
No.
Adjust R2 (COLOR REC LEVEL).
Yes.
0.28 Vp-p color signal is appeared on TP-1 of PRE/REboard with no FM signal.
No.
Check transistors X1, X2 X3—X7 on PRE/REC board.
Yes.
Transistors X10, X11 are turned on.
No.
Check X10, and X11.
Yes.
Color signal is appeared on TP-2 and TP-3 of PRE/ REC board.
No.
Transistors X8 and X9 are turned off. Check R27(REC COL. BAL.).

*The following excludes the E-to-E circuits.
**Y/C: Luminance and color printed circuit board.

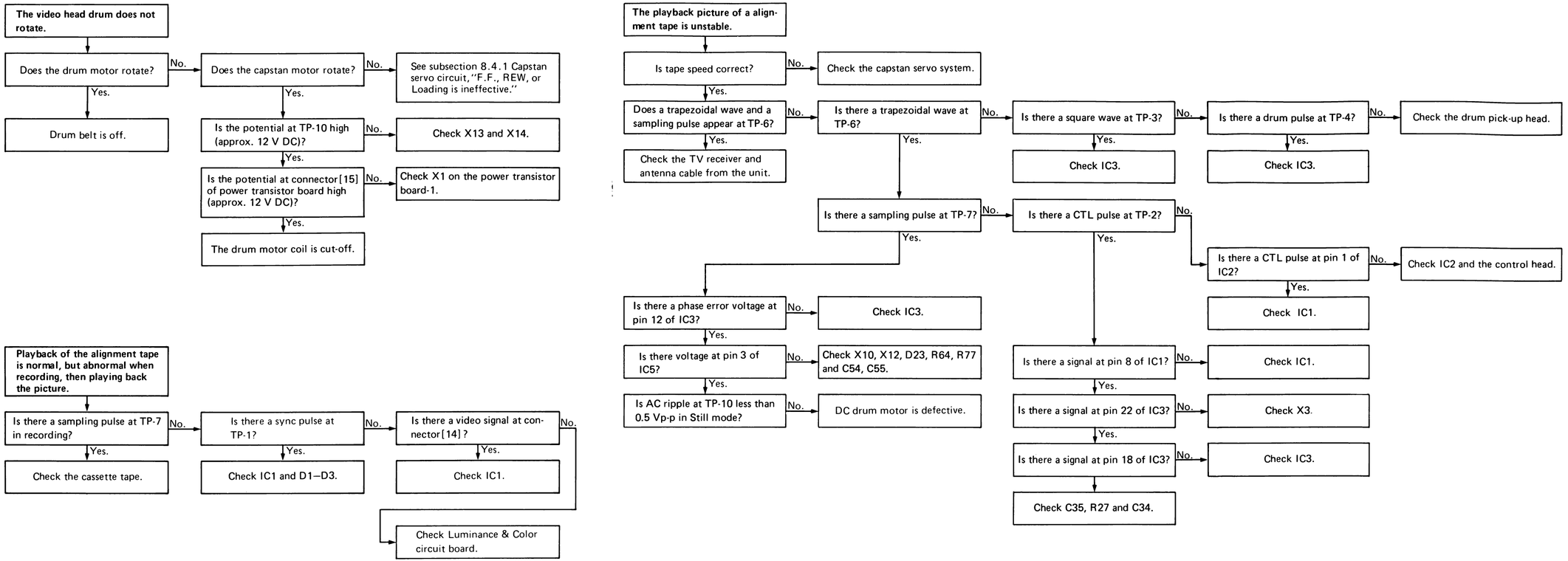
## 8.4 SERVO CIRCUIT

### 8.4.1 Capstan servo circuit


Fast Forward, Rewind or Loading function is ineffective.
Does the capstan motor rotate?
No.
DC potential on TP-7 is 7 V or more.
No.
Is 12 V DC supplied to connector [52] of the servo circuit?
No.
Check 12 V DC power line.
Yes.
Check the capstan belt, relay belt and loading mechanism.
Yes.
Is X5 turned on?
Yes.
Is 12 V DC supplied to connector [41] ?
No.
Check dew sensor circuit.
Yes.
Check pause switch S5.
Is 12 V DC supplied to connector [13] of power transistor board-2?
No.
Check 12 V DC power line.
Yes.
Is voltage supplied to connector [15] of power transistor board-2?
No.
Check X1 on the Power transistor board-2.
Yes.
The motor coil is open.
Still motion is ineffective when the Pause/Still key is depressed. (Tape travel does not stop in Still mode.)
Is the potential at pin [41] high?
No.
Check mechanism control circuit.
Yes.
Check D13 and X5.
Tape speed is abnormal in Record or Normal Playback mode.
Does a clamped pulse appear at TP-4?
No.
Is a 3.58-MHz wave generated at TP-3?
No.
Check the 3.58 MHz crystal and IC2.
Yes.
Does FG wave appear at TP-2?
No.
Does FG sine wave appear at TP-1?
Check FG gear and X1.
Yes.
Check R18, C10, X2, D5, D8 and IC3.
Check IC1 and IC2.
Is 12 V DC supplied to connector [54] ?
No.
Check A.L.* 12 V DC power supply system (after-loading switch, S6, or wiring).
Yes.
Check IC2, D3, D4 and D6.

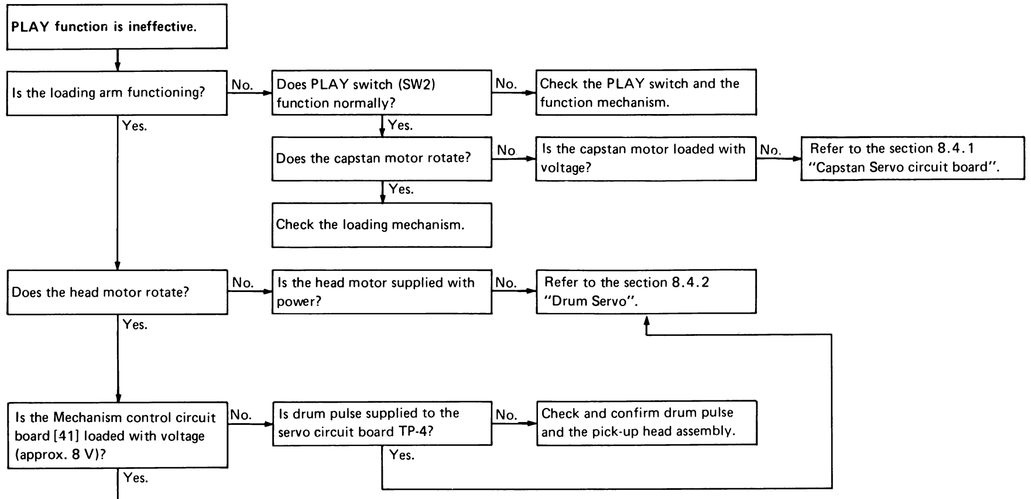
* A.L. = After Loading

### 8.4.2 Drum servo circuit

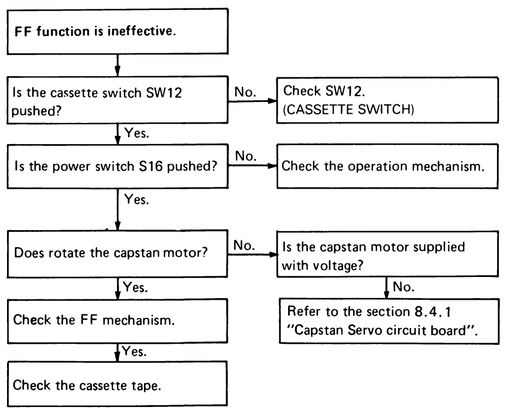

The video head drum does not rotate.
Does the drum motor rotate?
No.
Does the capstan motor rotate?
No.
See subsection 8.4.1 Capstan servo circuit, "F.F., REW, or Loading is ineffective."
Yes.
Drum belt is off.
Is the potential at TP-10 high (approx. 12 V DC)?
No.
Check X13 and X14.
Yes.
Is the potential at connector [15] of power transistor board high (approx. 12 V DC)?
No.
Check X1 on the power transistor board-1.
Yes.
The drum motor coil is cut-off.
Playback of the alignment tape is normal, but abnormal when recording, then playing back the picture.
Is there a sampling pulse at TP-7 in recording?
No.
Is there a sync pulse at TP-1?
No.
Is there a video signal at connector [14] ?
No.
Yes.
Check the cassette tape.
Check IC1 and D1—D3.
Check IC1.
Check Luminance & Color circuit board.
The playback picture of a alignment tape is unstable.
Is tape speed correct?
No.
Check the capstan servo system.
Yes.
Does a trapezoidal wave and a sampling pulse appear at TP-6?
No.
Is there a trapezoidal wave at TP-6?
No.
Is there a square wave at TP-3?
No.
Is there a drum pulse at TP-4?
No.
Check the drum pick-up head.
Yes.
Check the TV receiver and antenna cable from the unit.
Check IC3.
Check IC3.
Is there a sampling pulse at TP-7?
No.
Is there a CTL pulse at TP-2?
No.
Is there a CTL pulse at pin 1 of IC2?
No.
Check IC2 and the control head.
Yes.
Check IC1.
Is there a phase error voltage at pin 12 of IC3?
No.
Check IC3.
Is there voltage at pin 3 of IC5?
No.
Check X10, X12, D23, R64, R77 and C54, C55.
Is AC ripple at TP-10 less than 0.5 Vp-p in Still mode?
No.
DC drum motor is defective.
Is there a signal at pin 8 of IC1?
No.
Check IC1.
Is there a signal at pin 22 of IC3?
No.
Check X3.
Is there a signal at pin 18 of IC3?
No.
Check IC3.
Check C35, R27 and C34.

## 8-5 TROUBLESHOOTING OF MECHANISM AND MECHANISM CONTROLS

### 8-5-1 PLAY function is ineffective

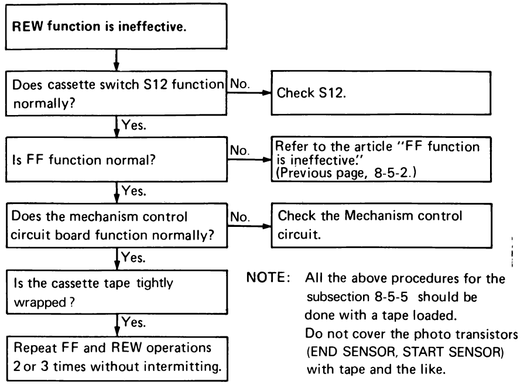

PLAY function is ineffective.
Is the loading arm functioning?
No.
Does PLAY switch (SW2) function normally?
No.
Check the PLAY switch and the function mechanism.
Yes.
Does the capstan motor rotate?
No
Is the capstan motor loaded with voltage?
No.
Refer to the section 8.4.1 "Capstan Servo circuit board".
Yes.
Check the loading mechanism.
Yes.
Does the head motor rotate?
No.
Is the head motor supplied with power?
No.
Refer to the section 8.4.2 "Drum Servo".
Yes.
Is the Mechanism control circuit board [41] loaded with voltage (approx. 8 V)?
No.
Is drum pulse supplied to the servo circuit board TP-4?
No.
Check and confirm drum pulse and the pick-up head assembly.
Yes.
Yes.
Is the stop solenoid operated?
No.
Check the loading arm locking mechanism.
Yes.
Check the mechanism control circuit board IC1.

### 8-5-2 F.F. function is ineffective



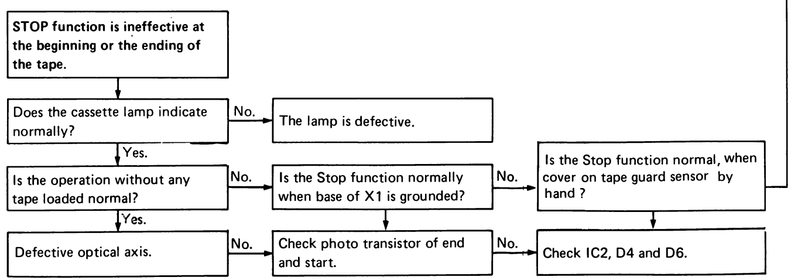

NOTE: All the following procedures for the articles 1 through 5 should be done without any cassette tape loaded. Cover the photo transistors (END SENSOR, START SENSOR) with black vinyl tape beforehand.

### 8.5.3 REW function is ineffective.

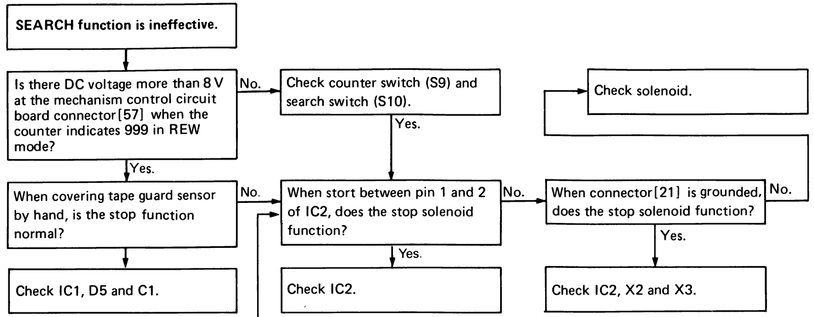

REW function is ineffective.
Does cassette switch S12 function normally?
No.
Check S12.
Yes.
Is FF function normal?
No.
Refer to the article "FF function is ineffective." (Previous page, 8-5-2.)
Yes.
Does the mechanism control circuit board function normally?
No.
Check the Mechanism control circuit.
Yes.
Is the cassette tape tightly wrapped?
Yes.
Repeat FF and REW operations 2 or 3 times without intermitting.

NOTE: All the above procedures for the subsection 8-5-5 should be done with a tape loaded. Do not cover the photo transistors (END SENSOR, START SENSOR) with tape and the like.

### 8.5.4 STOP function is ineffective.


STOP function is ineffective at the beginning or the ending of the tape.
Does the cassette lamp indicate normally?
No.
The lamp is defective.
Yes.
Is the operation without any tape loaded normal?
No.
Is the Stop function normally when base of X1 is grounded?
No.
Is the Stop function normal, when cover on tape guard sensor by hand ?
Yes.
Yes.
Defective optical axis.
No.
Check photo transistor of end and start.
No.
Check IC2, D4 and D6.

### 8.5.5 SEARCH function is ineffective.


SEARCH function is ineffective.
Is there DC voltage more than 8 V at the mechanism control circuit board connector [57] when the counter indicates 999 in REW mode?
No.
Check counter switch (S9) and search switch (S10).
Check solenoid.
Yes.
Yes.
When covering tape guard sensor by hand, is the stop function normal?
No.
When stort between pin 1 and 2 of IC2, does the stop solenoid function?
No.
When connector [21] is grounded, does the stop solenoid function?
No.
Yes.
Yes.
Yes.
Check IC1, D5 and C1.
Check IC2.
Check IC2, X2 and X3.

# SECTION 9
# EXPLODED VIEWS AND PARTS LIST


9.1 EXPLODED VIEW AND MAIN PARTS LIST
9.2 MAIN DECK – 1
9.3 MAIN DECK – 2
9.4 CHASSIS ASSEMBLY
9.5 DRUM ASSMBLY
9.6 CASSETTE HOUSING ASSMBLY
9.7 FUNCTION ASSEMBLY
9.8 CABINET ASSEMBLY


In this exploded views the part numbers of the screws and washers symbolize the shape of those items. The following examples will help you to decipher them.

Examples:

SPSP3006ZS
- "ISO" metric screw thread
- Length in mm (6mm)
- Diameter in mm (3mm)
- Cross-recrossed, pan head screw

LPSP3014ZS
- Length: 14mm
- Diameter: 3mm
- Cross-recrossed, pan head screw with lock washer

DPSP4008ZS
- Diameter: 4 mm
- Cross-recrossed, pan head screw with lock washer and plain washer

SSSP3008ZS
- Cross-recrossed, flat countersunk head screw

SDBP3006NS
- Cross-recrossed, binding head screw

YRS3004FS
- Hexagon socket set screw with sunken tip

YFS3006FS
- Hexagon socket screw with flat tip

BYS3006FS
- Hexagon socket head bolt

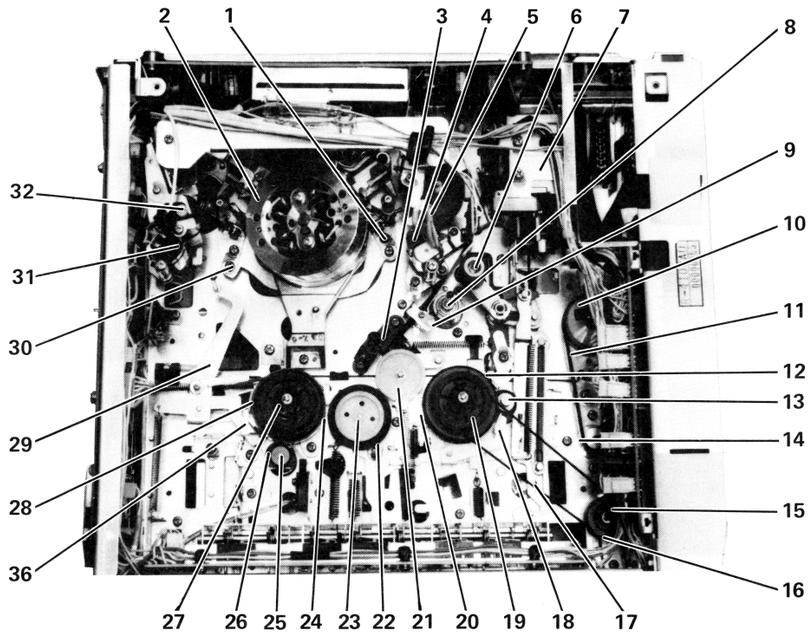
WLS3000
- Diameter of the screw applicable (3 mm screw)
- Lock washer

WNS3000Z
- Plain metal washer

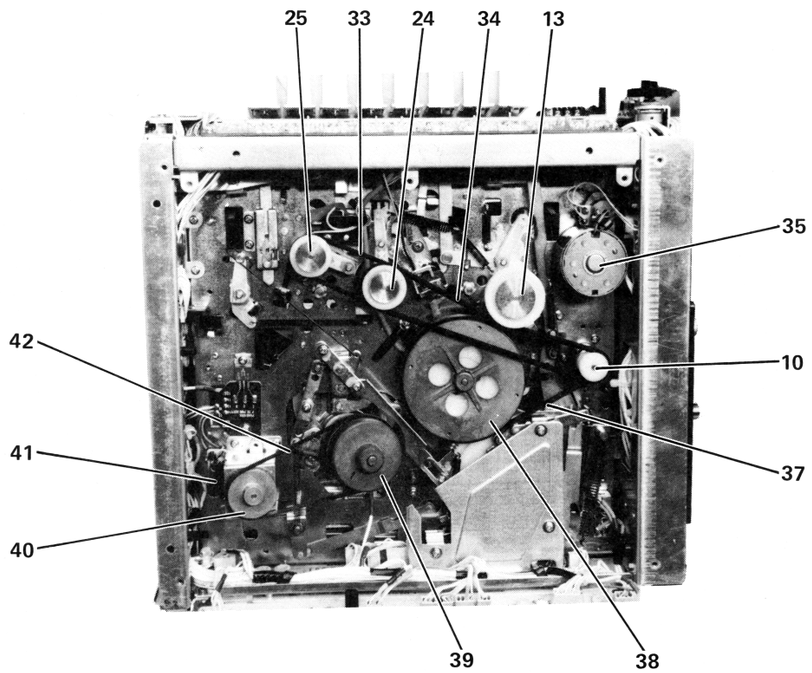
REE4000
- Diameter of the slot be around the face of the stud applicable (usually the stud's diameter is 5 mm and slot's one is 4 mm).
- Retaining ring ("E" type)

## 9.1 EXPLODED VIEW AND MAIN PARTS LIST

Upper view

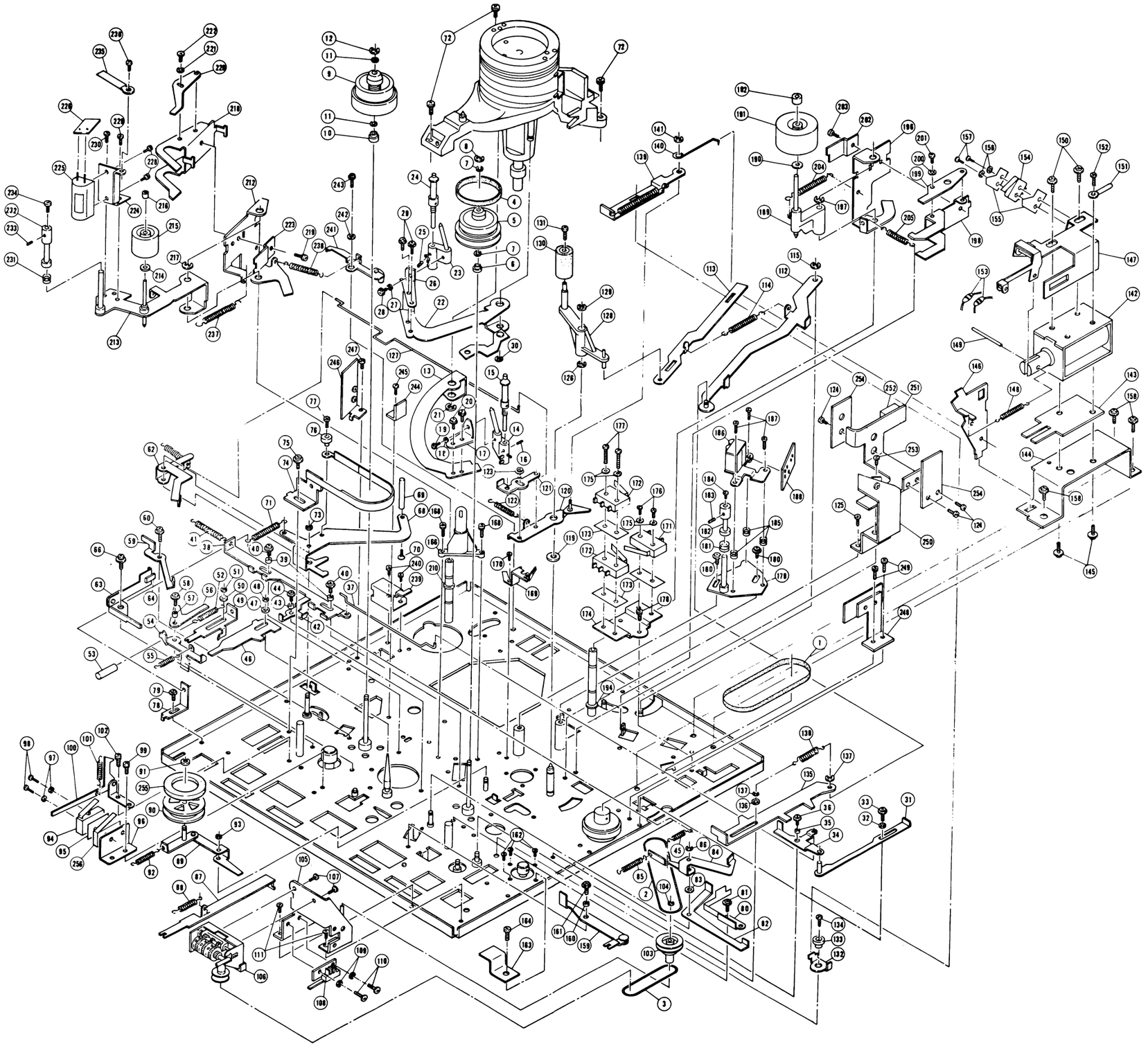



Bottom view




| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | – | Take-up Loading Arm | |
| 2 | PU31332G | Upper Drum Ass'y | |
| 3 | PUS46070 | Cassette Lamp Holder Ass'y | |
| 4 | PU46435-2M | Audio/Control & Erase Head Ass'y | |
| 5 | PU46288 | Take-up Impedance Roller | |
| 6 | PU47549A | Pinch Roller Ass'y | |
| 7 | PU47028 | Pinch Roller Solenoid | |
| 8 | PU46289A | Capstan Holder Ass'y | |
| 9 | PU46358A | Capstan Brush Ass'y | |
| 10 | PU46240B | Relay Pulley Ass'y | |
| 11 | PU44912 | Relay Belt | |
| 12 | PU44918 | Take-up Reel Disk Rubber Tire | |
| 13 | PU46862 | Take-up Idler Ass'y | |
| 14 | PU44900-3 | Capstan Motor Pulley | |
| 15 | PU44862 | Counter Pulley | |
| 16 | PU44863-2 | Counter Belt-2 | |
| 17 | PU44863 | Counter Belt-1 | |
| 18 | PU46246 | Take-up Brake | |
| 19 | PU44913A | Take-up Reel Disk Ass'y | |
| 20 | PU44827A | Take-up Loading Brake | |
| 21 | PU47279 | FF Pulley | (Except Rubber Tire) |
| 22 | PU44918-2 | REW Rubber Tire | |
| 23 | PU46380 | REW Idler Ass'y | |
| 24 | PU44853A | Tension Band Ass'y | |
| 25 | PU46381 | Unloading Idler Ass'y | |
| 26 | PU44918-3 | Unloading Rubber Tire | |
| 27 | PU44922A | Supply Reel Disk Ass'y | |
| 28 | PUS45886-B | Supply Loading Tension Brake Ass'y | |
| 29 | PU44851-2 | Tension Arm | |
| 30 | – | Supply Loading Arm | |
| 31 | PU31013 | Full Erase Head | |
| 32 | PU46288-2 | Supply Impedance Roller | |
| 33 | PU44912-3 | Unloading Belt | |
| 34 | PU44911 | Reel Drive Belt | |
| 35 | PU45979P | Capstan Motor | |
| 36 | PU46299A | Supply Brake Arm Ass'y | |
| 37 | PU44912-2 | Capstan Belt | |
| 38 | PU46236 | Capstan Flywheel | |
| 39 | PU46306A | Drum Pulley Ass'y | |
| 40 | PUS46023-0A | Drum Motor Pulley Ass'y | |
| 41 | PU44619 | Drum Motor | |
| 42 | PU44912-5 | Drum Belt | |

## 9.2 MAIN DECK 1



| *Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | PU44912 | Relay Belt | |
| 2 | PU44863 | Counter Belt-1 | |
| 3 | PU44863-2 | Counter Belt-2 | |
| 4 | PU44918 | Take-up Reel Disk Rubber Tire | |
| 5 | PU44913A | Take-up Reel Disk Ass'y | |
| 6 | PU45789 | Collar | |
| 7 | Q03093-834 | Washer | 0.13 thick for adjusting reel disk height |
| | " -827 | Washer | 0.25 thick " |
| | " -828 | Washer | 0.5 thick " |
| 8 | REE2000 | "E" Ring | |
| 9 | PU44922A | Supply Reel Disk Ass'y | |
| 10 | PU45789 | Collar | |
| 11 | Q03093-834 | Washer | 0.13 thick for adjusting reel disk height |
| | " -827 | Washer | 0.25 thick " |
| | " -828 | Washer | 0.5 thick " |
| 12 | REE2000 | "E" Ring | |
| 13 | PU46290B | Take-up Loading Arm Sub Ass'y | |
| 14 | PU44958B | Take-up Slant Pole Base Ass'y | |
| 15 | PU44952B | Guide Roller Ass'y | |
| 16 | YFS3004BS | Setscrew | |
| 17 | PU46262 | Holder Bracket (Take-up) | |
| 18 | T30302-025 | Collar | |
| 19 | DPSP3008ZS | Screw | |
| 20 | DPSP3005ZS | Screw | |
| 21 | REE3000 | "E" Ring | |
| 22 | PU46257A | Supply Loading Arm Sub Ass'y | |
| 23 | PU44949B | Supply Slant Pole Base Ass'y | |
| 24 | PU44952B | Guide Roller Ass'y | |
| 25 | YFS3004BS | Setscrew | |
| 26 | PU46261 | Holder Bracket (Supply) | |
| 27 | T30302-025 | Collar | |
| 28 | DPSP3008ZS | Screw | |
| 29 | DPSP3005ZS | Screw | |
| 30 | REE3000 | "E" Ring | |
| 31 | PU44891A | Slide Lever Ass'y | |
| 32 | T30302-008 | Collar | |
| 33 | DPSP3006ZS | Screw | |
| 34 | PU44821 | Connecting Lever | |
| 35 | PU43769-15 | Collar | |
| 36 | DPSP3006ZS | Screw | |
| 37 | PU44822 | Rod | |
| 38 | PU44825-2 | Slide Plate | |
| 39 | T30302-005 | Collar | |
| 40 | DPSP3006ZS | Screw | |
| 41 | T30300-59 | Spring | |
| 42 | PU44826 | Safety Plate Lock Lever | |
| 43 | — | — | |
| 44 | PU46732 | Flange Screw | |
| 45 | PU35005-28 | Spring | |
| 46 | PU46479 | OFF Lever | |
| 47 | Q03093-502 | Washer | |
| 48 | REE3000 | "E" Ring | |
| 49 | PU44845 | REW Lever | |
| 50 | Q03093-430 | Washer | |
| 51 | REE2500 | "E" Ring | |

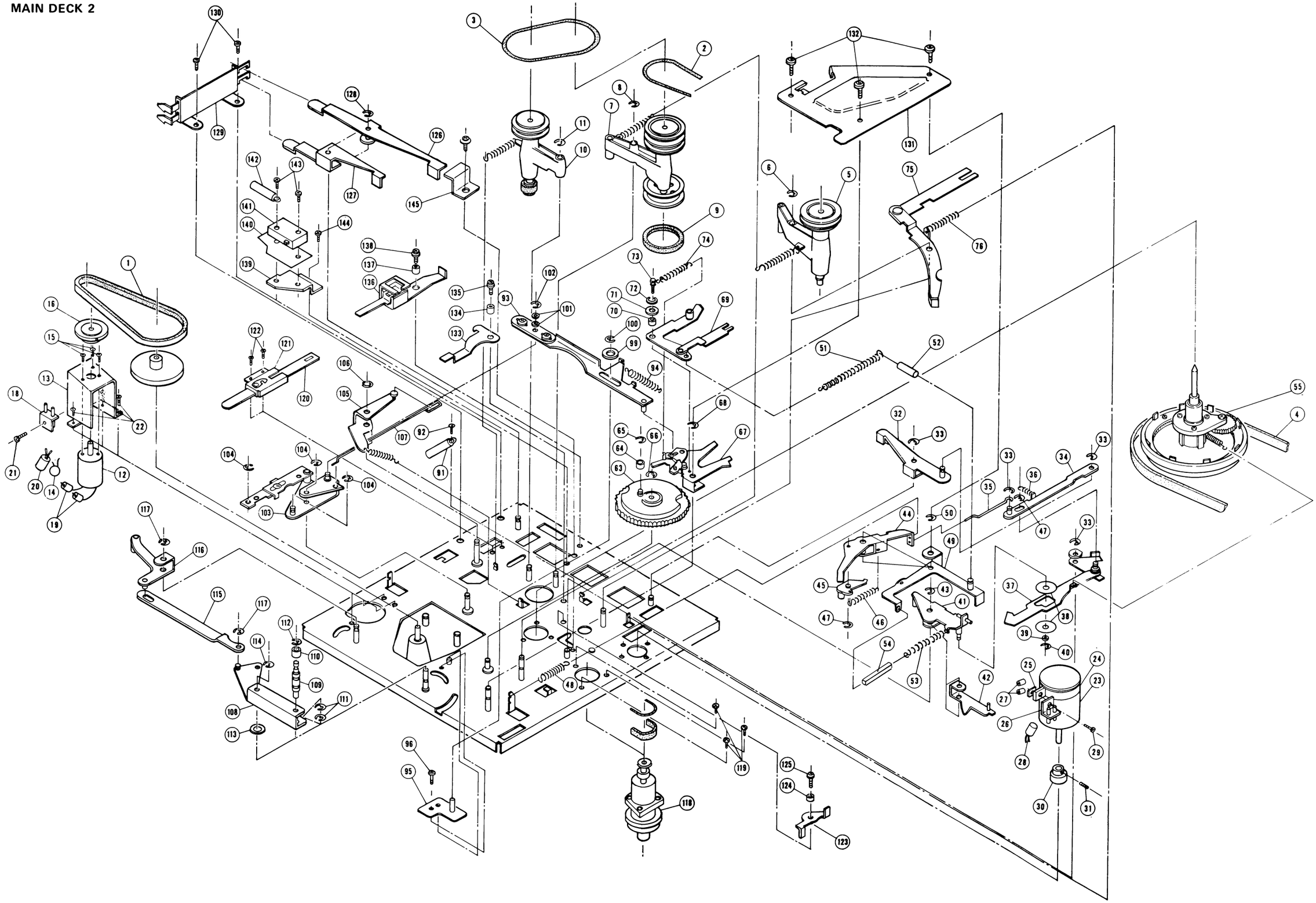
| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 52 | T30300-109 | Spring | |
| 53 | QXT658H-010 | Vinyl Tube | |
| 54 | PU46480 | Idler OFF Lever | |
| 55 | PU35005-70 | Spring | |
| 56 | PU45376 | Tension Arm OFF Lever | |
| 57 | PU43769-19 | Collar | |
| 58 | DPSP3008ZS | Screw | |
| 59 | PU44847 | Tension Arm Cancel Lever | |
| 60 | PU46732 | Flange Screw | |
| 61 | – | – | |
| 62 | PU46299A | Supply Brake Arm Ass'y | Incl. Spring (PU35005-92) |
| 63 | PU44830A | Supply Loading Tension Lever Ass'y | |
| 64 | PU42199 | Brake Shoe | ⑮ Supply Loading Tension Brake Ass'y |
| 65 | PUS45886 | Supply Loading Tension Brake Ass'y | |
| 66 | PU46732 | Flange Screw | |
| 67 | – | – | |
| 68 | PU44851-2 | Tension Arm | |
| 69 | PU44852 | Tension Pole | |
| 70 | SSSP2606Z | Screw | |
| 71 | PU35005-80 | Spring | |
| 72 | – | – | |
| 73 | REE2500 | "E" Ring | |
| 74 | PU44853A | Tension Band Ass'y | |
| 75 | DPSP3006ZS | Screw | |
| 76 | PU44859 | Washer | |
| 77 | SPBP2006N | Screw | |
| 78 | PU44823 | Bracket | |
| 79 | DPSP3006ZS | Screw | |
| 80 | PU44827A | Take-up Loading Brake Ass'y | |
| 81 | LPSP3006ZS | Screw | |
| 82 | PU44838-2 | Loading Brake OFF Lever | |
| 83 | Q03093-104 | Washer | |
| 84 | PU46246 | Take-up Brake Arm | |
| 85 | T30300-49 | Spring | |
| 86 | REE2500 | "E" Ring | |
| 87 | PU44837 | F.F. Lever | |
| 88 | T30300-109 | Spring | |
| 89 | PU44833B | F.F. Arm Ass'y | |
| 90 | PU47279 | F.F. Idler | |
| 91 | REE2500 | "E" Ring | |
| 92 | PU35005-28 | Spring | |
| 93 | REE3000 | "E" Ring | |
| 94 | QSM1S11-201 | Microswitch | S12 (Cassette SW) |
| 95 | PU44212 | Spacer | |
| 96 | PU45459-2 | Switch Bracket | |
| 97 | WLS2300N | Lock Washer | |
| 98 | SPBP2310N | Screw | |
| 99 | LPSP3006ZS | Screw | |
| 100 | PU44848A | REC Safety Lever Ass'y | |
| 101 | PU35005-34 | Spring | |
| 102 | LPSP3006ZS | Screw | |
| 103 | PU44862 | Counter Pulley Ass'y | |
| 104 | REE2500 | "E" Ring | |
| 105 | PU45873B | Counter Bracket Ass'y | |
| 106 | PU44669 | Tape Counter | |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 107 | LPSP3005ZS | Screw | |
| 108 | PU44738 | Push Switch | S10 (Search SW) |
| 109 | WLS2000N | Lock Washer | |
| 110 | SPSP2004Z | Screw | |
| 111 | LPSP3004ZS | Screw | |
| 112 | PU45283A | Pinch Roller Slide Plate (1) Ass'y | |
| 113 | PU45286-2 | Pinch Roller Slide Plate (2) Ass'y | |
| 114 | PU35005-67 | Spring | |
| 115 | REE3000 | "E" Ring | |
| 116 | – | – | |
| 117 | – | – | |
| 118 | – | – | |
| 119 | Q03093-221 | Washer | |
| 120 | PU46220A | Pause Lever Ass'y | |
| 121 | PU46622 | Adjusting Plate | |
| 122 | T30300-11 | Spring | |
| 123 | DPSP3006ZS | Screw | |
| 124 | DPSP3005ZS | Screw | |
| 125 | LPSP3006ZS | Screw | |
| 126 | REE5000 | "E" Ring | |
| 127 | PU46265 | Rod | |
| 128 | PU45279B | Pinch Roller Lever Ass'y | |
| 129 | REE5000 | "E" Ring | |
| 130 | PU47549A | Pinch Roller Ass'y | |
| 131 | LPSP2604Z | Screw | |
| 132 | PU46224 | Lever | |
| 133 | PU46230 | Washer | |
| 134 | SSSP3006ZS | Screw | |
| 135 | PU46227 | Memory Plate | |
| 136 | Q03093-502 | Washer | |
| 137 | REE3000 | "E" Ring | |
| 138 | PU35005-40 | Spring | |
| 139 | PU46317A | Pinch Roller Cancel Lever Ass'y | |
| 140 | PU46223 | Rod | |
| 141 | REE3000 | "E" Ring | |
| 142 | PU47028 | Pause Solenoid | |
| 143 | PU46426 | Guide | |
| 144 | PU46213 | Solenoid Bracket | |
| 145 | DPSP3005ZS | Screw | |
| 146 | PU46219 | Lever | |
| 147 | PU46379A | Lever Ass'y | |
| 148 | T30300-004 | Spring | |
| 149 | PRE3022 | Spring Pin | |
| 150 | DPSP3005ZS | Screw | |
| 151 | PUS45919-0A | Wire Clamp | |
| 152 | DPSP3005ZS | Screw | |
| 153 | V03C | Diode | D101 ,D102 |
| 154 | QSM1S11-023 | Microswitch | S11 (Pinch SW) |
| 155 | PU46484 | Spacer | |
| 156 | WLS2300 | Lock Washer | |
| 157 | SPBP2310N | Screw | |
| 158 | DPSP3006ZS | Screw | |
| 159 | PU448840-B | Eject Plate Ass'y | |
| 160 | T30302-008 | Collar | |
| 161 | DPSP3006ZS | Screw | |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 162 | LPSP3005ZS | Screw | |
| 163 | PU46526 | Belt Guard | |
| 164 | LPSP3006ZS | Screw | |
| 165 | – | – | |
| 166 | PUS46070 | Cassette Lamp Holder Ass'y | |
| 167 | – | – | |
| 168 | LPSP3006ZS | Screw | |
| 169 | PU46358A | Brush Holder Ass'y | Incl. Brush (PU44972A) |
| 170 | LPSP3006ZS | Screw | |
| 171 | QSM1S01-028 | Microswitch | S6 (A. L SW) |
| 172 | QSM1S11-201 | Microswitch | S7, 8 (UL-1, 2) |
| 173 | PU44212 | Spacer | |
| 174 | PU44898-2 | Switch Bracket | |
| 175 | WLS2300N | Lock Washer | |
| 176 | SPBP2310N | Screw | |
| 177 | SPBP2318N | Screw | |
| 178 | LPSP3006ZS | Screw | |
| 179 | PU45331A | Audio/Control Head Base Ass'y | |
| 180 | DPSP3008ZS | Screw | |
| 181 | PU30080-49 | Spring | |
| 182 | PU45271-2 | Take-up Guide Pole | |
| 183 | YFS3004BS | Setscrew | |
| 184 | SDBP3006RS | Screw | |
| 185 | PU30080-49 | Spring | |
| 186 | PU46435-2M | Audio/Control Head Sub Ass'y | |
| 187 | SPSP3010ZS | Screw | |
| 188 | – | Audio/Control Head P.C.B. Ass'y | See page 11-15. |
| 189 | PU45256A | Take-up Arm Ass'y | |
| 190 | Q03093-829 | Washer | |
| 191 | PU46288 | Take-up Impedance Roller | |
| 192 | PU46263 | Stopper | |
| 193 | – | – | |
| 194 | Q03093-508 | Washer | |
| 195 | – | – | |
| 196 | PU45261 | Lever | |
| 197 | REE5000 | "E" Ring | |
| 198 | PU45262 | Take-up Lock Arm | |
| 199 | PU45354 | Take-up Guide Roller Stopper | |
| 200 | WNB2600N | Washer | |
| 201 | SPSP2603Z | Screw | |
| 202 | PU45263 | Spring Plate | |
| 203 | LPSP3006ZS | Screw | |
| 204 | PU35005-96 | Spring | |
| 205 | T30300-114 | Spring | |
| 206 | – | – | |
| 207 | – | – | |
| 208 | – | – | |
| 209 | – | – | |
| 210 | Q03093-508 | Washer | |
| 211 | – | – | |
| 212 | PU45272 | Lever | |
| 213 | PU45264B | Head Arm Ass'y | |
| 214 | Q03093-830 | Washer | |
| 215 | PU46288-2 | S. Impedance Roller | |
| 216 | PU46263 | Stopper | |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 217 | REE5000 | "E" Ring | |
| 218 | PU45273 | S. Lock Arm | |
| 219 | LPSP3006ZS | Screw | |
| 220 | PU45353 | S. Roller Stopper | |
| 221 | WNB2600N | Washer | |
| 222 | SPSP2603Z | Screw | |
| 223 | PU45263 | Spring Plate | |
| 224 | PU45270-2 | F.E.H. Holder | |
| 225 | PU31013 | Full Erase Head | |
| 226 | – | Full Erase Head P.C.B. | See page 11-15. |
| 227 | – | – | |
| 228 | LPSP2004Z | Screw | |
| 229 | LPSP3005ZS | Screw | |
| 230 | SPSP3006ZS | Screw | |
| 231 | PU30080-49 | Spring | |
| 232 | PU45271 | Guide Pole | |
| 233 | YFS3004BS | Setscrew | |
| 234 | SDBP3006RS | Screw | |
| 235 | PUS45919-0A | Wire Clamp | |
| 236 | LPSP3006ZS | Screw | |
| 237 | PU35005-86 | Spring | |
| 238 | " -41 | Spring | |
| 239 | PU47533 | Guide | |
| 240 | LPSP3006ZS | Screw | |
| 241 | PU46086-2 | Lock Lever | |
| 242 | T30302-004 | Collar | |
| 243 | DPSP3005ZS | Screw | |
| 244 | PU46470 | Arm Stopper | |
| 245 | SDBP3006NS | Screw | |
| 246 | – | END Sensor P.C.B. Ass'y | See page 11-15. |
| 247 | LPSP3006ZS | Screw | |
| 248 | – | Start Sensor P,C.B. Ass'y | See page 11-15. |
| 249 | LPSP3006ZS | Screw | |
| 250 | PU46247 | Cassette Door Guide | |
| 251 | PU46255 | CdS Holder | |
| 252 | PU46356 | Cushion | |
| 253 | LPSP3006ZS | Screw | |
| 254 | – | Tape Guard P.C.B Ass'y | See page 11-14. |
| 255 | PU44918-4 | FF Rubber Tire | |
| 256 | PU47376 | Leaf Spring | |

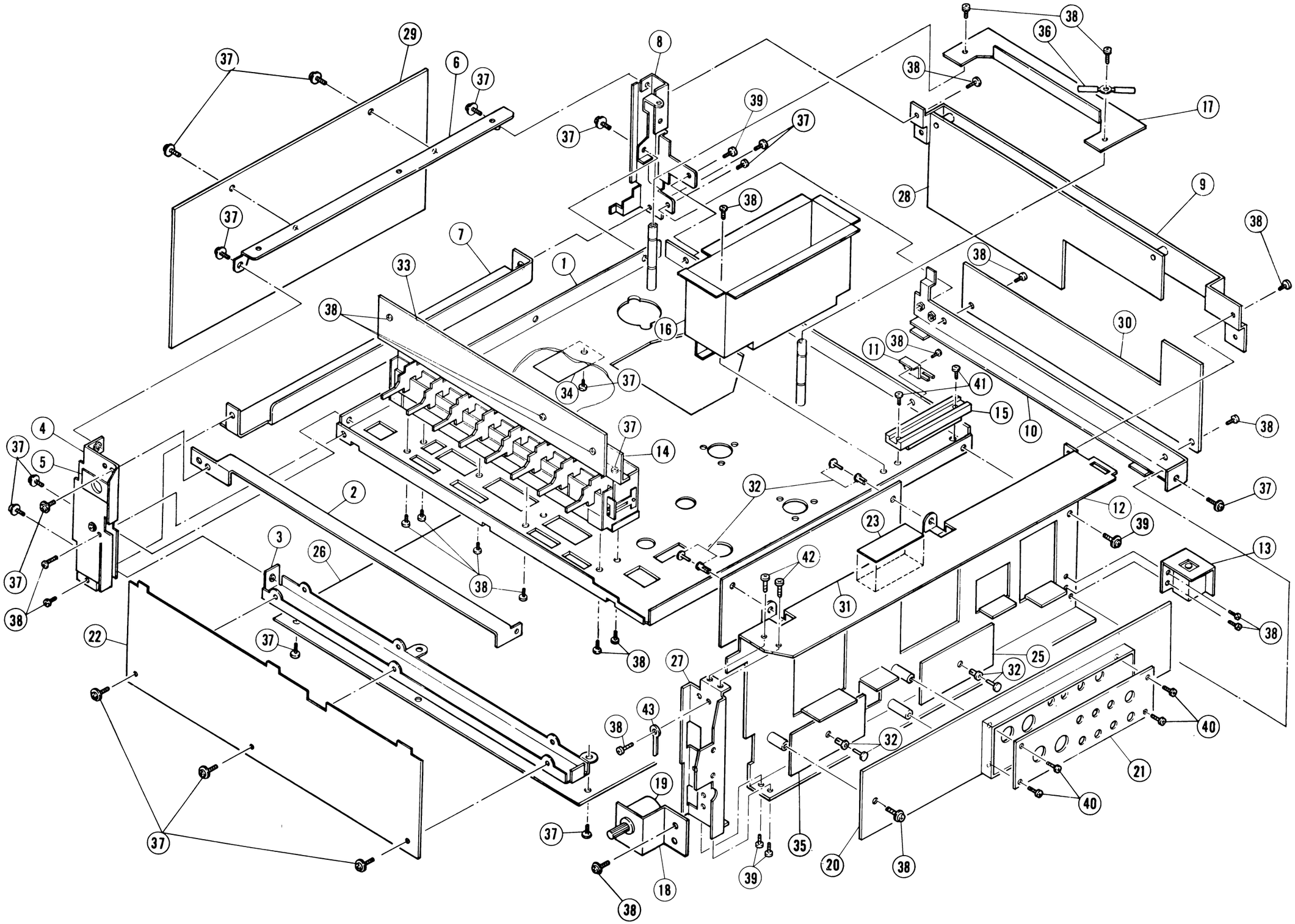
## 9.3 MAIN DECK 2



| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | PU44912-5 | Drum Belt | |
| 2 | PU44911 | Reel Drive Belt | |
| 3 | PU44912-3 | Unloading Idler Belt | |
| 4 | PU44912-2 | Capstan Belt | |
| 5 | PU47752 | Take-up Idler Ass'y | Incl. Spring (PU35005-14) |
| 6 | REE3000 | "E" Ring | |
| 7 | PU47753 | REW Idler Ass'y | Incl. Spring (PU35005-73) |
| 8 | REE3000 | "E" Ring | |
| 9 | PU44918-2 | REW Rubber Tire | |
| 10 | PU46381 | Unloading Idler Ass'y | Incl. Rubber Tire (PU44918-3) |
| 11 | REE3000 | "E" Ring | Spring (T30300-114) or PU46414M |
| 12 | PU44619 | Drum Motor | |
| 13 | PU31335-2 | Drum Motor Bracket | |
| 14 | QCF31HP-103 | Ceramic Capacitor | Assembled from: |
| 15 | LPSP2004Z | Screw | Motor Pulley (PU45326) |
| 16 | PUS46023-0A | Drum Motor Pulley Ass'y | Oil Fence (PU47391) |
| 17 | LPSP3006ZS | Screw | Set Screw; 56 |
| 18 | V03082-2 | Feed Through Capacitor Ass'y | C103 |
| 19 | PU45811 | Ferrite Beads | K1, 2 |
| 20 | QEW41HA-105 | Electrolytic Capacitor | C101 |
| 21 | DPSP3006ZS | Screw | |
| 22 | LPSP3004ZS | Screw | |
| 23 | PU45979P | Capstan Motor | or PU45979M |
| 24 | PU45980 | Capstan Motor Band | |
| 25 | PU43730 | Tapping Plate | |
| 26 | V03082-2 | Feed Through Capacitor Ass'y | C104 |
| 27 | PU45811 | Ferrite Beads | K3, 4 |
| 28 | QEW41HA-105 | Electrolytic Capacitor | C102 |
| 29 | LPSP3010ZS | Screw | |
| 30 | PU44900-3 | Capstan Motor Pulley | |
| 31 | YWS3003PS | Setscrew | |
| 32 | PU45313A | Play Lever (1) Ass'y | |
| 33 | REE3000 | "E" Ring | |
| 34 | PU45319A | Play Lever (2) Ass'y | |
| 35 | PU45321 | Rod | |
| 36 | PU35005-6 | Spring | |
| 37 | PU45315C | Play Lever (3) Ass'y | |
| 38 | Q03093-620 | Washer | |
| 39 | Q03093-102 | Washer | |
| 40 | REE3000 | "E" Ring | |
| 41 | PU45299A | Change Lever Ass'y | |
| 42 | PU45301A | Kick Lever Ass'y | |
| 43 | REE5000 | "E" Ring | |
| 44 | PU45306A | Change Arm Lock Lever Ass'y | |
| 45 | PU45308A | Drive Arm Lock Lever Ass'y | |
| 46 | PU35005-53 | Spring | |
| 47 | REE3000 | "E" Ring | |
| 48 | PU35005-16 | Spring | |
| 49 | PU45303A | Timing Arm Ass'y | |
| 50 | REE5000 | "E" Ring | |
| 51 | PU35005-93 | Spring | |
| 52 | QXT665H-025 | Vinyl Tube | |
| 53 | T30300-003 | Spring | |
| 54 | GA40154-2 | Moltplen | |
| 55 | PUS35813 | Capstan F.G. Holder Ass'y | Change them by C.F.G.H. Ass'y |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 56 | – | – | |
| 57 | – | – | |
| 58 | – | – | |
| 59 | – | – | |
| 60 | – | – | |
| 61 | – | – | |
| 62 | DPSP3006ZS | Screw | |
| 63 | PU45311A | Timing Gear Ass'y | |
| 64 | PU43769-22 | Collar | |
| 65 | REE3000 | "E" Ring | |
| 66 | REE4000 | "E" Ring | |
| 67 | PU45242A | Drive Arm Ass'y | |
| 68 | REE5000 | "E" Ring | |
| 69 | PU45247A | Change Arm Ass'y | |
| 70 | T30300-025 | Collar | |
| 71 | Q03091-103 | Washer | |
| 72 | WLS3000N | Lock Washer | |
| 73 | PU44224 | Spring Hook | |
| 74 | PU35005-74 | Spring | |
| 75 | PU46228B | Lock Lever Ass'y | |
| 76 | PU35005-41 | Spring | |
| 77 | – | – | |
| 78 | – | – | |
| 79 | – | – | |
| 80 | – | – | |
| 81 | – | – | |
| 82 | – | – | |
| 83 | – | – | |
| 84 | – | – | |
| 85 | – | – | |
| 86 | – | – | |
| 87 | – | – | |
| 88 | – | – | |
| 89 | – | – | |
| 90 | – | – | |
| 91 | DPSP3006ZS | Wire Clamp Screw | |
| 92 | LPSP3006ZS | Screw | |
| 93 | PU45841A | Slide Plate Ass'y | |
| 94 | PU35005-75 | Spring | |
| 95 | PU46853A | Spring Plate Ass'y | |
| 96 | DPSP3006ZS | Screw | |
| 97 | – | – | |
| 98 | – | – | |
| 99 | Q03093-502 | Washer | |
| 100 | REE3000 | "E" Ring | |
| 101 | Q03093-502 | Washer | |
| 102 | REE3000 | "E" Ring | |
| 103 | PU46256A | Rotary Lever Ass'y | |
| 104 | REE3000 | "E" Ring | |
| 105 | PU46283A | Tension Cam Ass'y | Incl. Spring (PU35005-26) |
| 106 | REE3000 | "E" Ring | |
| 107 | PU44883 | Rod | |
| 108 | PU45250A | Take-up Lock Lever Ass'y | |
| 109 | PU45252 | Stud | |
| 110 | PU43709-23 | Collar | |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 111 | REE4000 | "E" Ring | |
| 112 | REE3000 | "E" Ring | |
| 113 | Q03093-507 | Washer | |
| 114 | REE5000 | "E" Ring | |
| 115 | PU45255 | Connecting Lever | |
| 116 | PU45253C | Supply Lock Lever Ass'y | |
| 117 | REE3000 | "E" Ring | |
| 118 | PU46240B | Relay Pulley Ass'y | |
| 119 | LPSP3006ZS | Screw | |
| 120 | PU44871A | Pause Lever Ass'y | |
| 121 | PU44874A | Lock Bracket Ass'y | |
| 122 | LPSP3006ZS | Screw | |
| 123 | PU46226 | Take-up Idler OFF Lever | |
| 124 | PU43769-15 | Collar | |
| 125 | DPSP3006ZS | Screw | |
| 126 | PU46249 | Full Record Lever | |
| 127 | PU46248 | Dubbing Lever | |
| 128 | REE3000 | "E" Ring | |
| 129 | PU46348A | Record Plate Ass'y | |
| 130 | LPSP3006ZS | Screw | |
| 131 | PU45325 | Plate | |
| 132 | DPSP3006ZS | Screw | |
| 133 | PU46338 | Stop Lever | |
| 134 | T30302-004 | Collar | |
| 135 | DPSP3006ZS | Screw | |
| 136 | PU46335A | Stop Solenoid Ass'y | |
| 137 | T30302-005 | Collar | |
| 138 | DPSP3006ZS | Screw | |
| 139 | PU46481 | Switch Holder | |
| 140 | PU46482 | Insulator | |
| 141 | QSM1V01-024 | Power Switch | S16 (Power SW) |
| 142 | PUS45919-0A | Wire Clamp | |
| 143 | LPSP3014ZS | Screw | |
| 144 | LPSP3006ZS | Screw | |
| 145 | PU46526 | Belt Guard | |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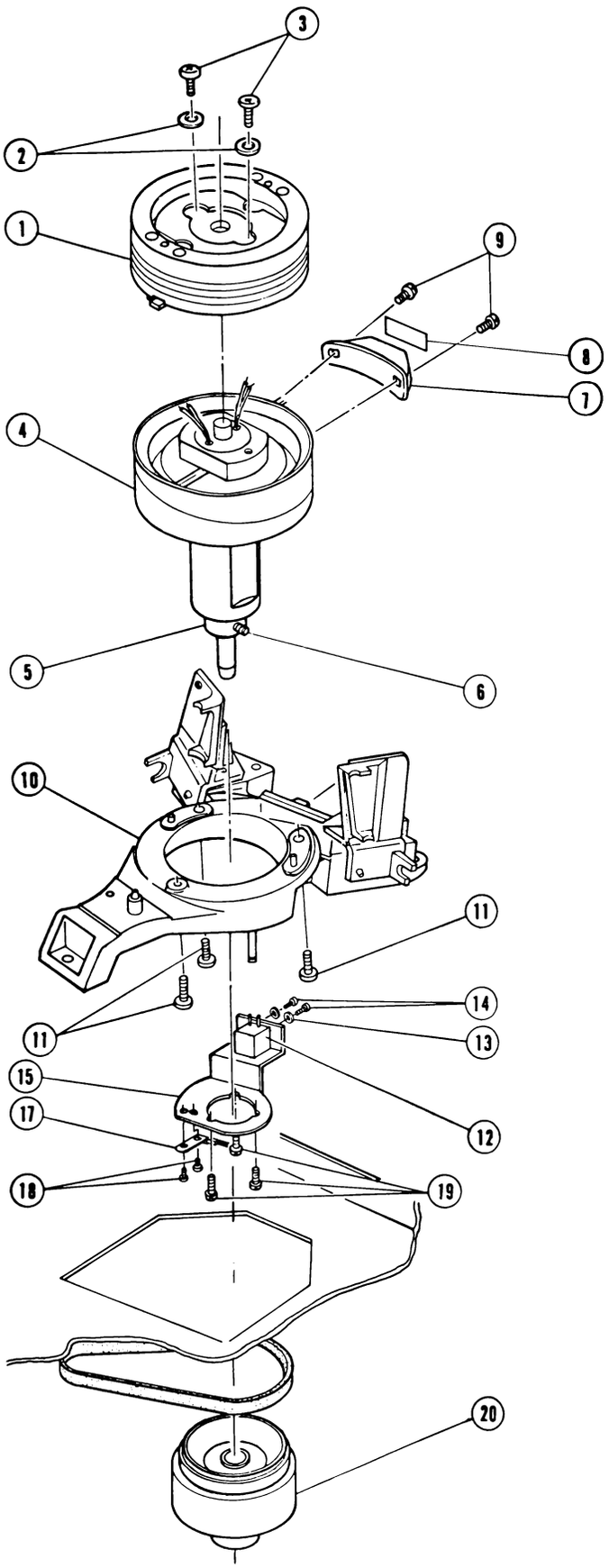
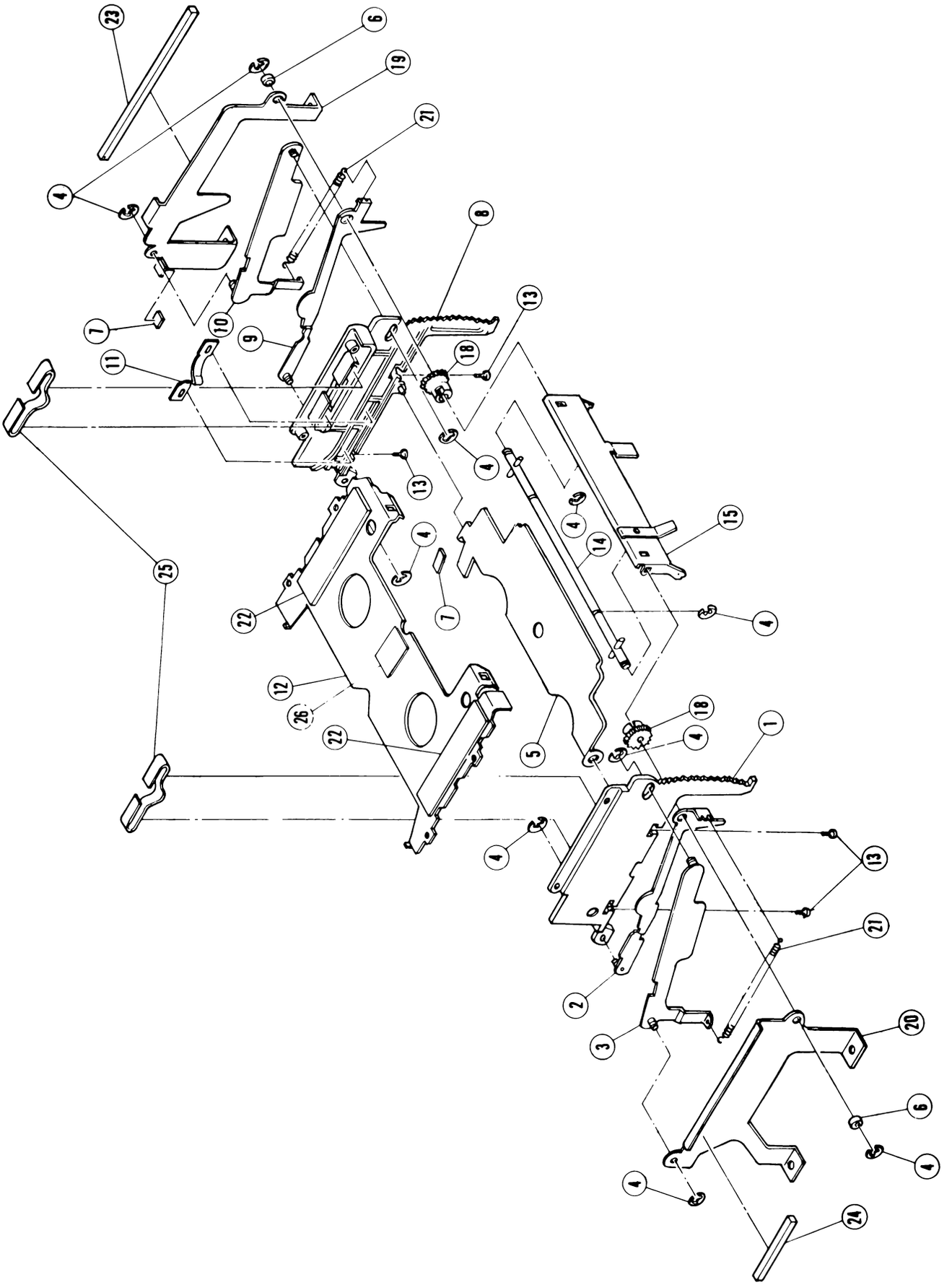
| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | – | Main Deck Ass'y | |
| 2 | PU31555A | Stay Ass'y | |
| 3 | PU31556B | CAP/REG P.C.B. Bracket Ass'y | |
| 4 | PU31557A | Bracket (2) Ass'y | |
| 5 | PU46525 | Insulator | |
| 6 | PU31558A | Stay Ass'y | |
| 7 | PU31559A | A/S P.C.B. Bracket | |
| 8 | PU31560A | Bracket (3) Ass'y | |
| 9 | PU31561A | Stay Ass'y | |
| 10 | PU31562A | Stay Ass'y | Incl. Hinge (PU46374) |
| 11 | PU46199 | P.C.B. Holder | |
| 12 | PU20773A | Side Bracket Sub Ass'y | |
| 13 | PU46287A | Battery Holder Ass'y | |
| 14 | PU31573 | OPE. P.C.B. Bracket | |
| 15 | PU45160 | RF Connector | |
| 16 | PU31531 | RF Case | |
| 17 | PU46266 | Wire Clamp Plate | |
| 18 | PU47341 | V.R. Holder | |
| 19 | QVF166B-0F5P | V.R. | |
| 20 | – | CONN. P.C.B. Ass'y | See page 11-1. |
| 21 | PU46196 | Connector Panel | |
| 22 | – | CAP/REG. P.C.B. Ass'y | See page 11-2. |
| 23 | PUP40329 | No. Plate | |
| 24 | – | Power Transistor Board (3) | See page 11-15. |
| 25 | – | – | – |
| 26 | – | Y/C P.C.B. Ass'y | See page 11-4. |
| 27 | PU31991 | Handle Holder | |
| 28 | – | PRE/REC P.C.B. Ass'y | See page 11-9. |
| 29 | – | A/S P.C.B. Ass'y | See page 11-11. |
| 30 | – | JUMP P.C.B. Ass'y | See page 11-13. |
| 31 | – | MECHA. CON. P.C.B. Ass'y | See page 11-14. |
| 32 | E48729-001 | Plastic Rivet | |
| 33 | – | OPE. P.C.B. Ass'y | See page 11-14. |
| 34 | – | Power Transistor P.C.B (1) | See page 11-15. |
| 35 | – | Power Transistor P.C.B (2) | See page 11-15. |
| 36 | PUS45921-0A | Wire Clamp | |
| 37 | DPSP3006ZS | Screw | |
| 38 | LPSP3006ZS | Screw | |
| 39 | SSSP3004ZS | Screw | |
| 40 | SDSP3006ZS | Screw | |
| 41 | LPSP3008ZS | Screw | |
| 42 | LPSP3005ZS | Screw | |
| 43 | 55234 | Wire Clamp | |

## 9.5 DRUM ASSEMBLY



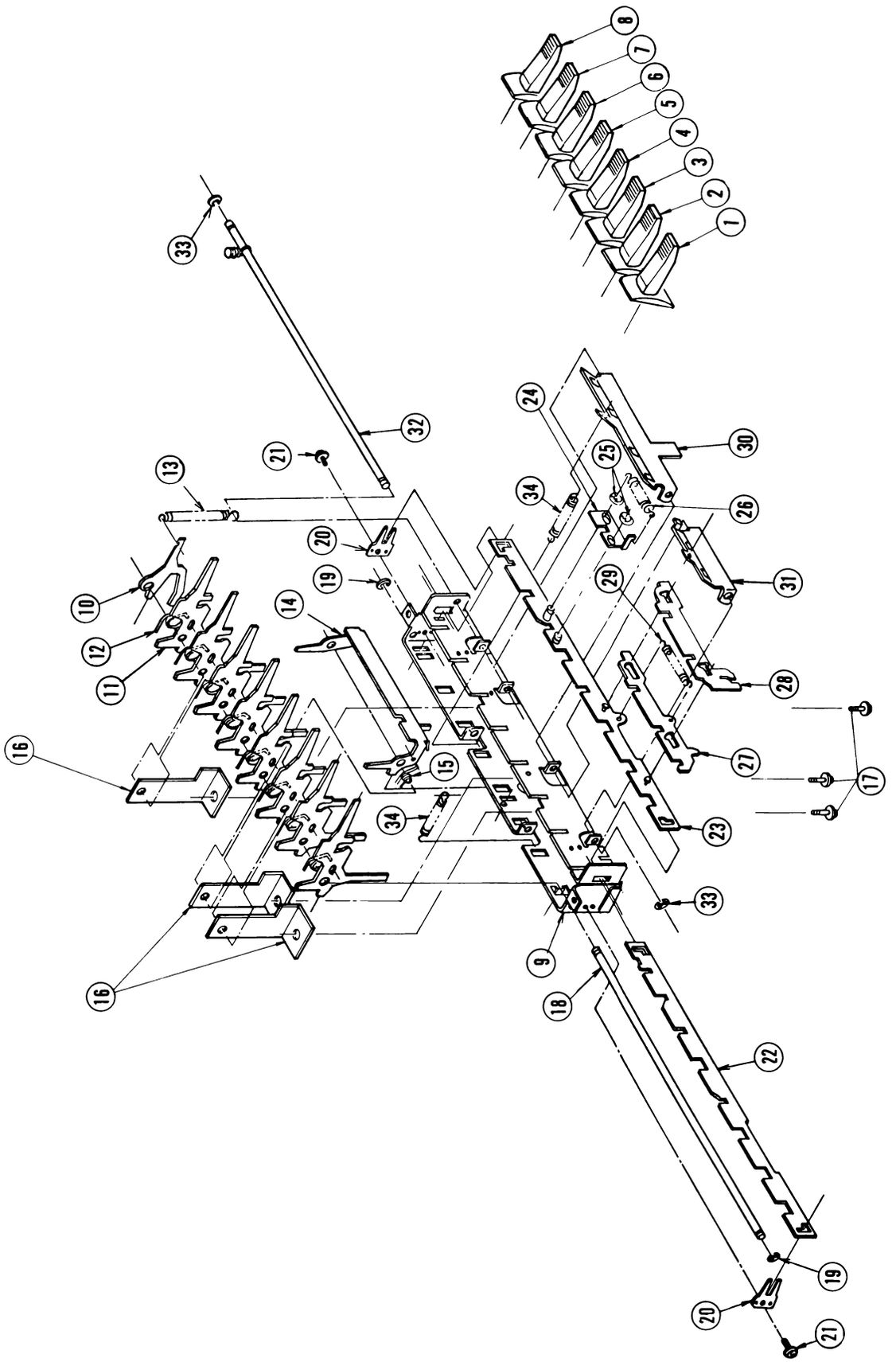
| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | PU31332G | Upper Drum Ass'y | |
| 2 | WNB3000N | Washer | |
| 3 | SPBP3010NS | Screw | |
| 4 | PU31328C | Lower Drum Sub Ass'y | |
| 5 | PU44969 | Collar | ④ Lower Drum Sub Ass'y |
| 6 | YWS3003 | Setscrew | |
| 7 | PU46295 | Dew Senser Bracket | |
| 8 | PU46305 | Dew Senser | |
| 9 | SDBP3006NS | Screw | |
| 10 | – | Drum Base Ass'y | Don't Supply for Service Parts |
| 11 | SDBP3008NS | Screw | |
| 12 | PU47199 | Pick-up Head | |
| 13 | WSB2000N | Washer | |
| 14 | SPBP2003N | Screw | |
| 15 | PU44971-2 | Pick-up Head Bracket | |
| 16 | – | – | |
| 17 | PU44972A | Brush Ass'y | |
| 18 | SPBP2003N | Screw | |
| 19 | LPSP2606Z | Screw | |
| 20 | **PU47661A** | Drum Pulley Ass'y | Incl. Setscrew (YFS4006BS) |

## 9.6 CASSETTE HOUSING ASSEMBLY



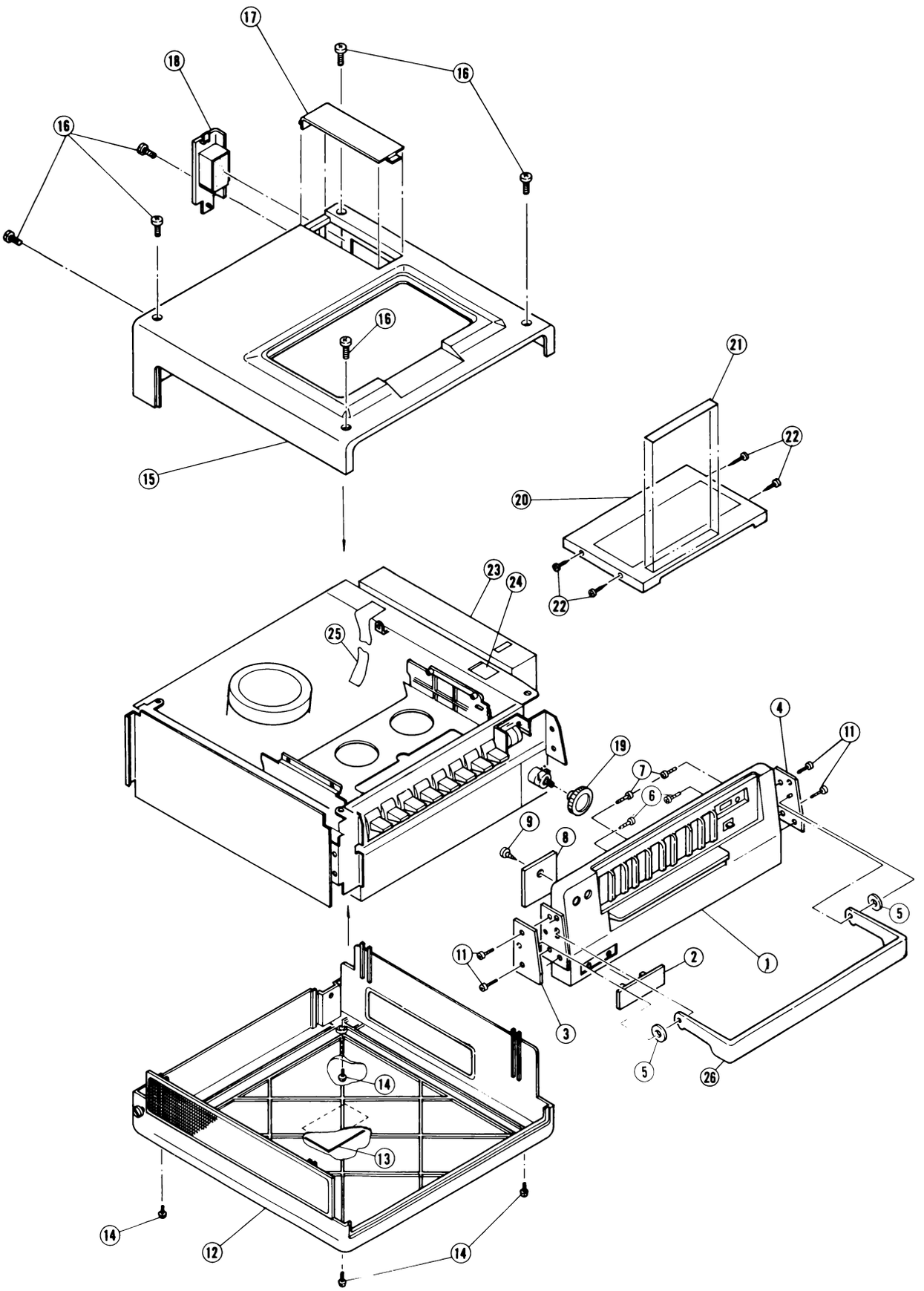
| *Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | PU20544 | Housing | Left side |
| 2 | PU31336B | Lower Arm Ass'y | Left side |
| 3 | PU45360C | Upper Arm Ass'y | Left side |
| 4 | REE4000 | "E" Ring | |
| 5 | PU31904B | Cover Ass'y | |
| 6 | PU43769-26 | Collar | |
| 7 | PU45673 | Cushion | |
| 8 | PU20543 | Housing | Right side |
| 9 | PU31336A | Lower Arm Ass'y | Right side |
| 10 | PU45360D | Upper Arm Ass'y | Right side |
| 11 | PU45550 | Off Spring | |
| 12 | PU31337-2 | Plate | |
| 13 | LPSP2606Z | Screw | (27) Cassette Housing Ass'y |
| 14 | PU45363A | Shaft Ass'y | |
| 15 | PU31491A | Lock Lever Ass'y | |
| 16 | – | – | |
| 17 | – | – | |
| 18 | PU45364 | Gear | |
| 19 | PU45358 | Bracket | Right side |
| 20 | PU45909 | Bracket | Left side |
| 21 | T30300-93 | Spring | |
| 22 | PU40867-2 | Felt-1 | |
| 23 | PU45509-2 | Shade | |
| 24 | PU45509-3 | Shade | |
| 25 | PU45549 | Spring | |
| 26 | PU40867-3 | Felt-2 | |
| 27 | PUS25491-0B-P | Cassette Housing Ass'y | |

## 9.7 FUNCTION ASSEMBLY



| *Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | PU46360A | PAUSE Button Ass'y | |
| 2 | " B | AUDIO DUB Button Ass'y | |
| 3 | " C | REC Button Ass'y | |
| 4 | " D | REW Button Ass'y | |
| 5 | " E | STOP Button Ass'y | |
| 6 | " F | PLAY Button Ass'y | |
| 7 | " G | F.F. Button Ass'y | |
| 8 | " H | EJECT Button Ass'y | |
| 9 | PU20540-2 | Button Case | |
| 10 | PU44800 | Lock Lever | |
| 11 | PU44799 | Lever | |
| 12 | PU45800 | Return Spring | |
| 13 | PU35005-99 | Spring | |
| 14 | PU31321-2 | Swing Plate | |
| 15 | PU44231 | Spring | |
| 16 | PU46469 | Bracket | |
| 17 | SPSP3006ZS | Screw | ⑮ Function Ass'y |
| 18 | PU44801 | Shaft | Note: Charge them by Function Ass'y |
| 19 | REE3000 | "E" Ring | except ① – ⑧. |
| 20 | PU44802 | Flat Spring | |
| 21 | DPSP3006ZS | Screw | |
| 22 | PU31322 | Function Plate (A) | |
| 23 | PU31323A | Function Plate (B) Ass'y | |
| 24 | PU45539 | Function Plate (D) | |
| 25 | REE2500 | "E" Ring | |
| 26 | PU35005-72 | Spring | |
| 27 | PU44803 | Function Plate (C) | |
| 28 | PU45856 | Function Plate (E) | |
| 29 | PU35005-22 | Spring | |
| 30 | PU46250 | Lock Plate (L) | |
| 31 | PU44805 | Lock Plate (S) | |
| 32 | PU44806 | Shaft | |
| 33 | REE2500 | "E" Ring | |
| 34 | PU35005-17 | Spring | |
| 35 | PUS25490B | Function Ass'y | |

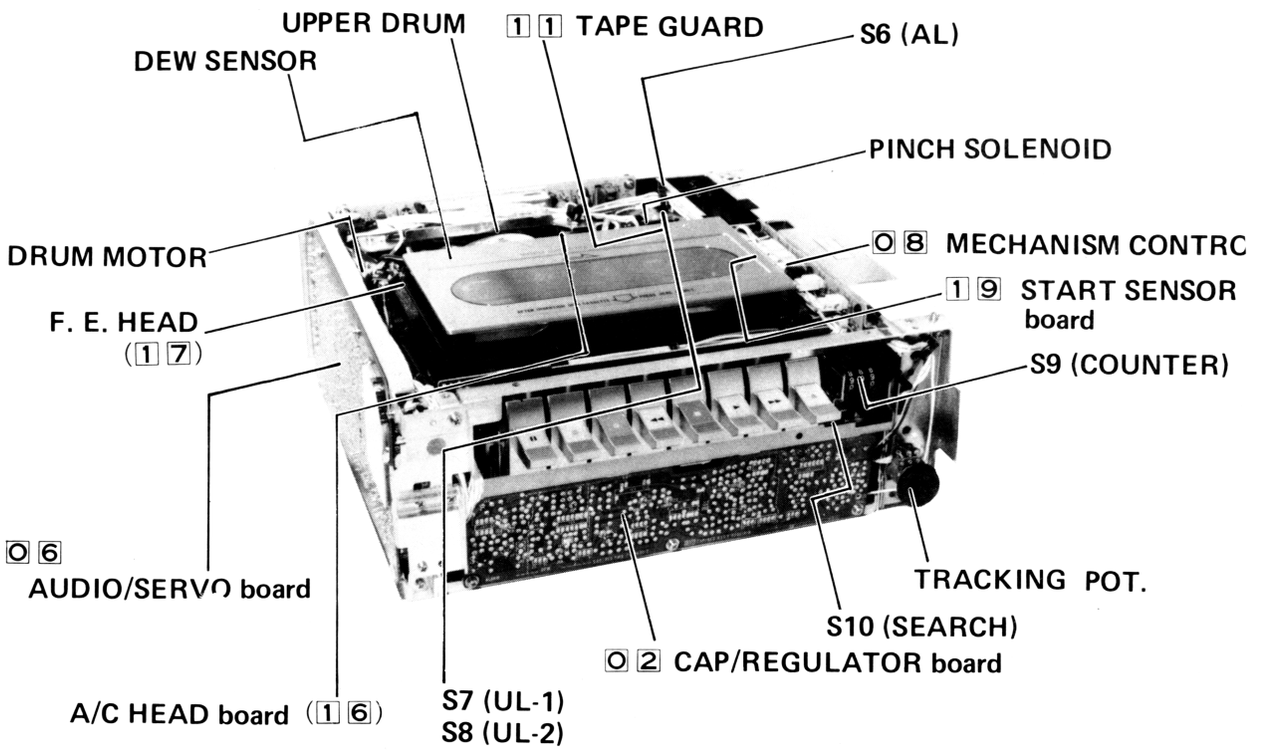
## 9.8 CABINET ASSEMBLY

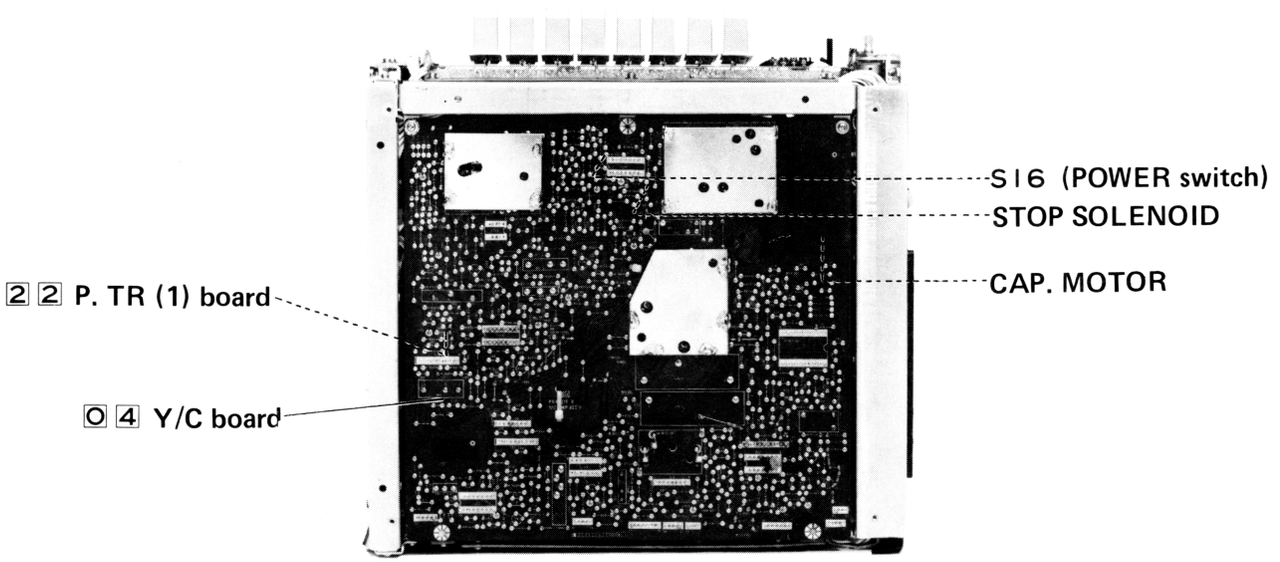


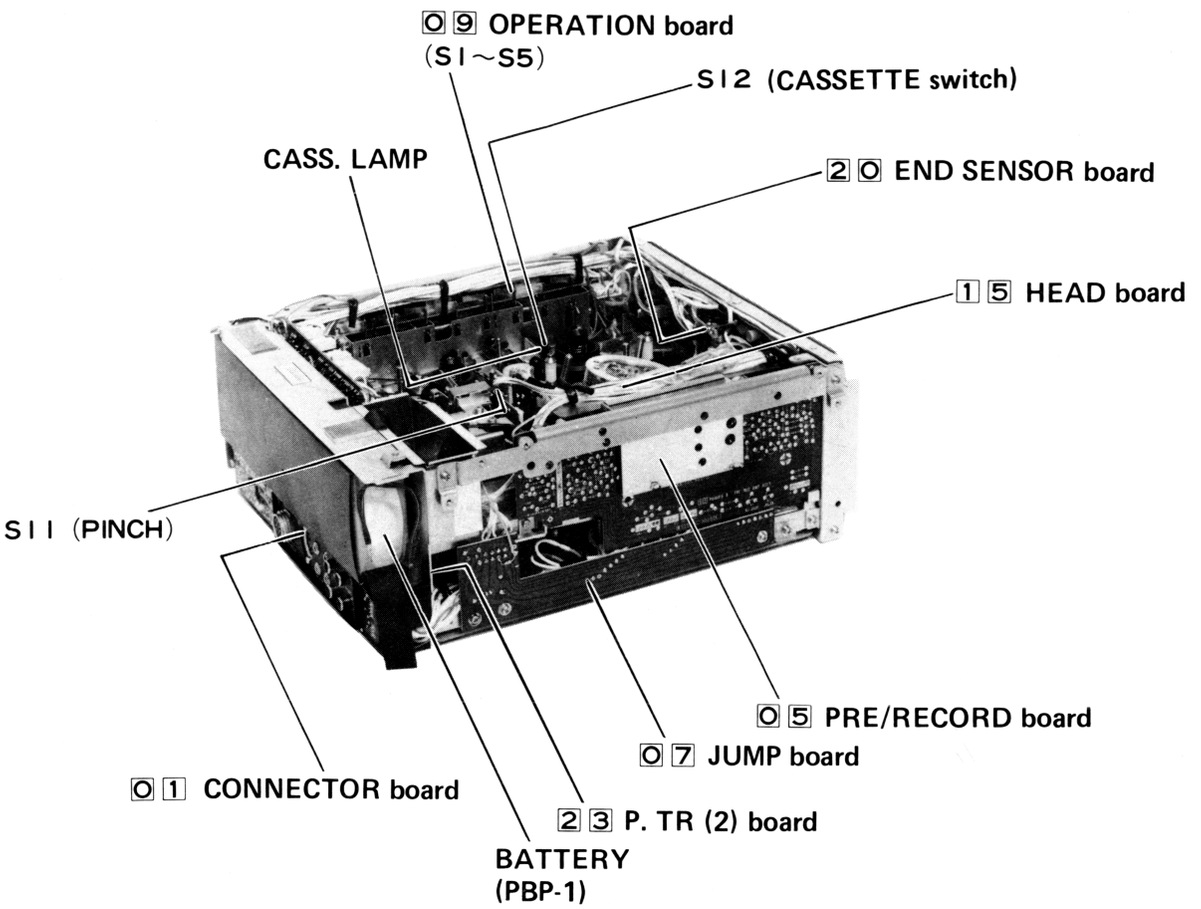
| *Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| 1 | PU10136B | Front Cover Sub Ass'y | |
| 2 | A48494A | Mark | |
| 3 | PU31552 | Handle Base | Left side |
| 4 | PU31552-2 | Handle Base | Right side |
| 5 | Q03093-505 | Washer | (10) Front Cover Ass'y |
| 6 | LPSP3006ZS | Screw | |
| 7 | LPSP3008ZS | Screw | |
| 8 | – | LED P.C.B. Ass'y | REF. [1] [8] |
| 9 | SDSA3008ZS | Tapping Screw | |
| 10 | PU10132B | Front Cover Ass'y | |
| 11 | SSSP3014BS | Screw | |
| 12 | PU10133F | Bottom Cover Ass'y | |
| 13 | PU31054-94 | Serial Number Plate | EG Type |
| | " -95 | " | EK Type |
| 14 | SDBP3006RS | Screw | |
| 15 | PU10134C | Top Cover Ass'y | |
| 16 | SDBP3006RS | Screw | |
| 17 | PU46432A | RF Cover Ass'y | |
| 18 | PU46433A | Battery Cover Ass'y | |
| 19 | PU46194 | Tracking Knob | |
| 20 | PU31708C | Cassette Cover Ass'y | |
| 21 | PU45968 | Label | |
| 22 | SDSA3010ZS | Tapping Screw | |
| 23 | PU31533 | Battery Case | |
| 24 | PU44227 | Battery Band | |
| 25 | PU46378 | RF Band | |
| 26 | PU31598A | Handle Ass'y | |

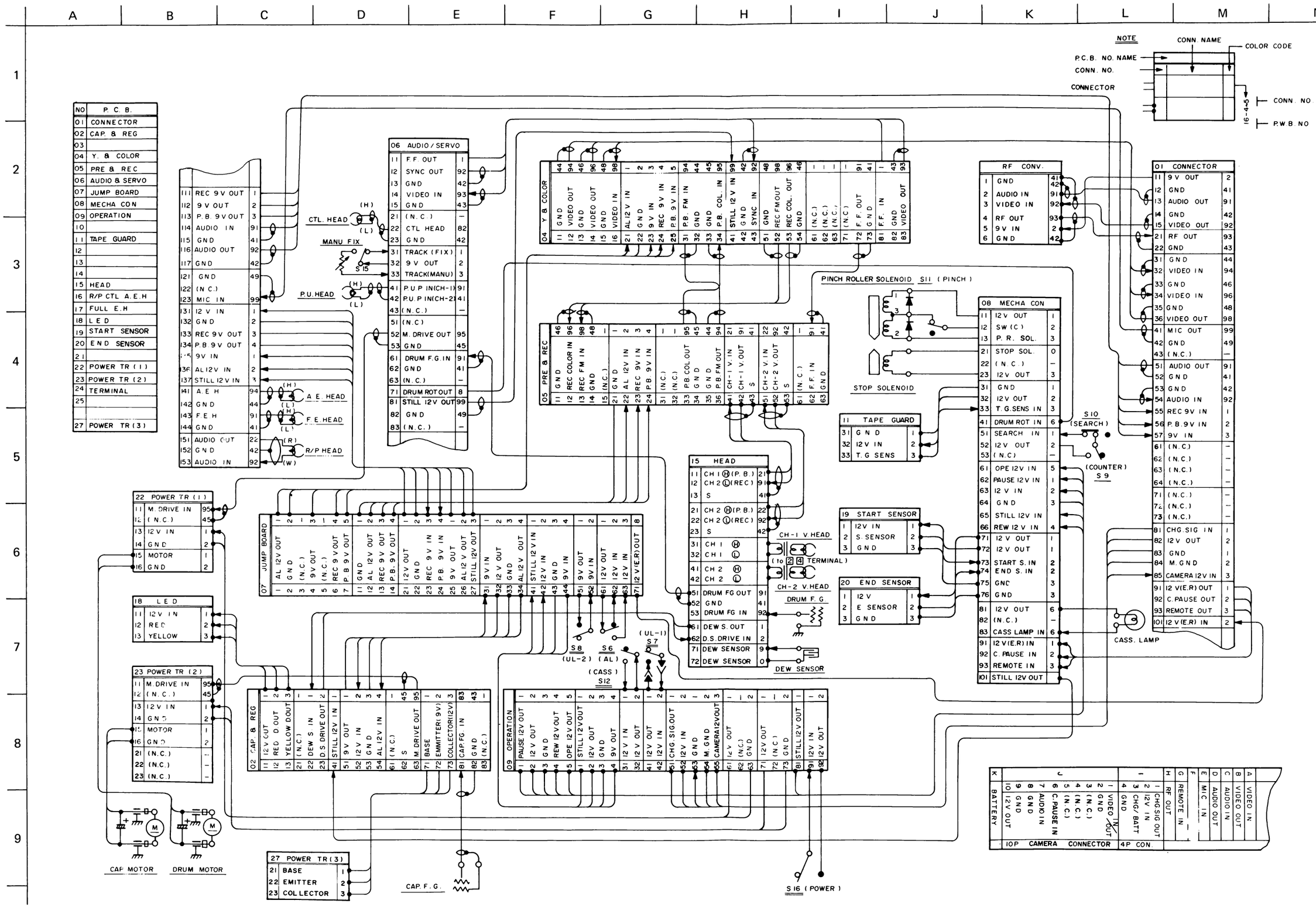
# SECTION 10
# CHARTS AND DIAGRAMS

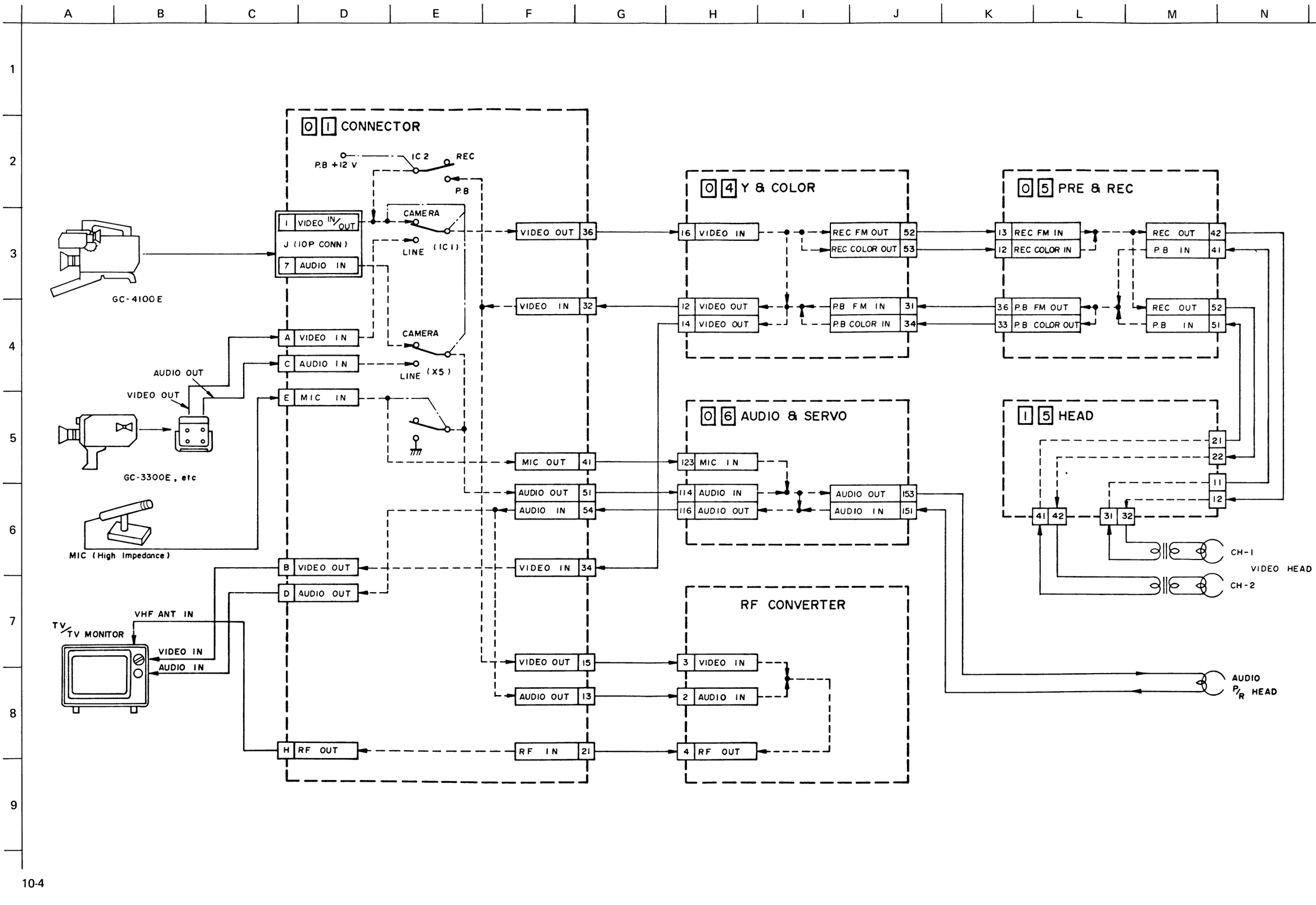
## 10.1 ELCTRICAL PARTS LOCATION

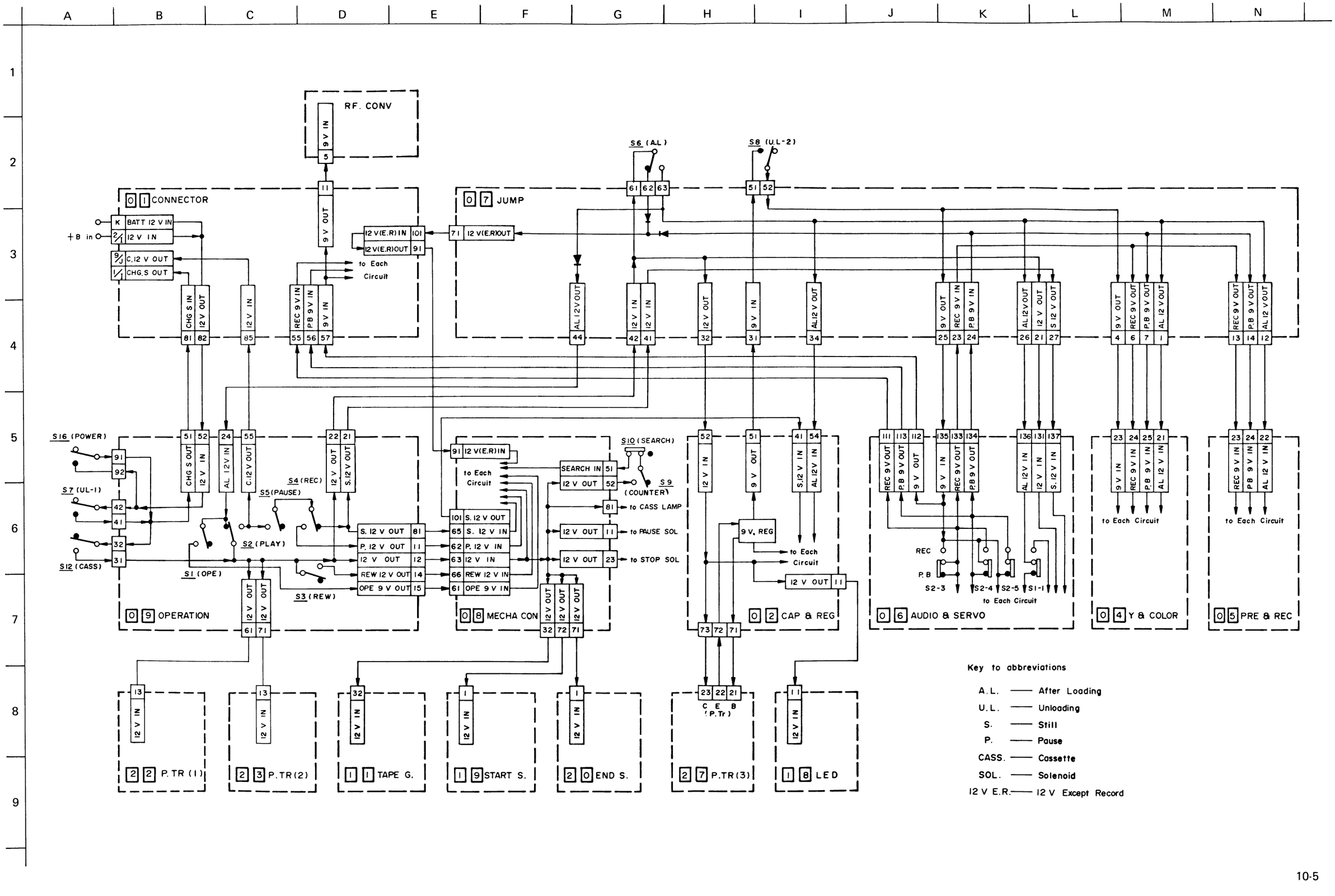



09 OPERATION board
(S1~S5)
S12 (CASSETTE switch)
CASS. LAMP
20 END SENSOR board
15 HEAD board
S11 (PINCH)
05 PRE/RECORD board
07 JUMP board
01 CONNECTOR board
23 P. TR (2) board
BATTERY
(PBP-1)


NOTE
CONN. NAME
COLOR CODE
P.C.B. NO. NAME
CONN. NO.
CONNECTOR
CONN. NO.
P.W.B. NO
16-4-5
NO P. C. B.
01 CONNECTOR
02 CAP. & REG
03
04 Y. & COLOR
05 PRE & REC
06 AUDIO & SERVO
07 JUMP BOARD
08 MECHA CON
09 OPERATION
10
11 TAPE GUARD
12
13
14
15 HEAD
16 R/P CTL A.E.H
17 FULL E.H
18 LED
19 START SENSOR
20 END SENSOR
21
22 POWER TR (1)
23 POWER TR (2)
24 TERMINAL
25
27 POWER TR (3)
06 AUDIO / SERVO
CTL. HEAD
MANU FIX.
S15
P.U.HEAD
A.E.HEAD
F.E.HEAD
R/P HEAD
04 Y & COLOR
05 PRE & REC
RF CONV.
01 CONNECTOR
PINCH ROLLER SOLENOID S11 (PINCH)
STOP SOLENOID
08 MECHA CON
11 TAPE GUARD
S10 (SEARCH)
(COUNTER) S9
19 START SENSOR
20 END SENSOR
CASS. LAMP
15 HEAD
CH-1 V.HEAD
(1o 2 4 TERMINAL)
CH-2 V.HEAD
DRUM F.G
DEW SENSOR
07 JUMP BOARD
22 POWER TR (1)
18 LED
23 POWER TR (2)
S8 (UL-2)
S6 (AL)
(UL-1) S7
(CASS) S12
02 CAP. & REG
09 OPERATION
CAP. MOTOR
DRUM MOTOR
27 POWER TR (3)
CAP. F. G.
S16 (POWER)
10P CAMERA CONNECTOR
4P CON.
BATTERY
VIDEO IN/OUT
REMOTE IN/OUT
MIC IN

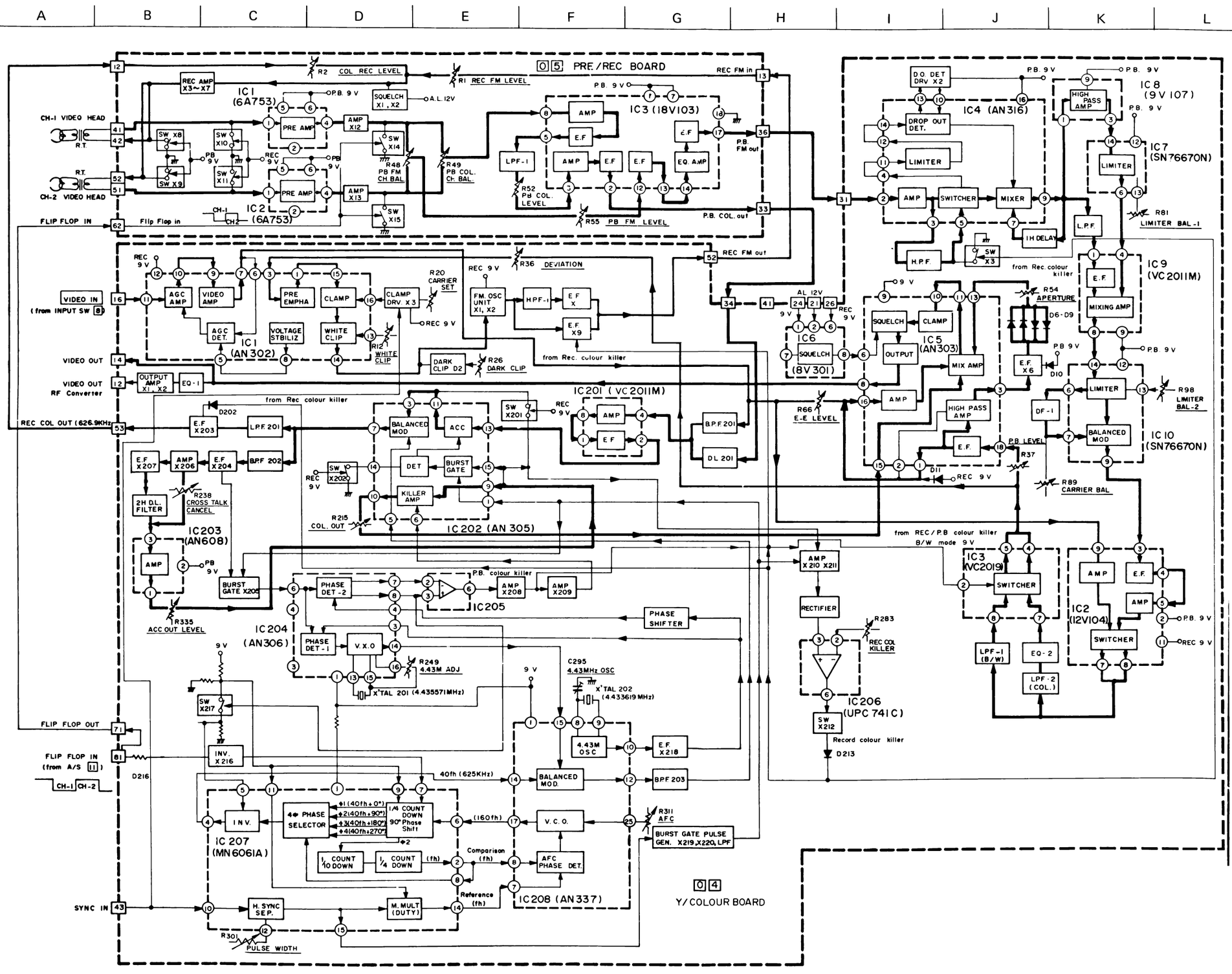

01 CONNECTOR
P.B +12 V
IC 2
REC
P.B
1 VIDEO IN/OUT
J (10P CONN)
7 AUDIO IN
CAMERA
LINE (IC1)
VIDEO OUT 36
VIDEO IN 32
GC-4100E
A VIDEO IN
C AUDIO IN
CAMERA
LINE (X5)
AUDIO OUT
VIDEO OUT
E MIC IN
GC-3300E, etc
MIC (High Impedance)
MIC OUT 41
AUDIO OUT 51
AUDIO IN 54
B VIDEO OUT
D AUDIO OUT
VIDEO IN 34
VHF ANT IN
TV/TV MONITOR
VIDEO IN
AUDIO IN
VIDEO OUT 15
AUDIO OUT 13
H RF OUT
RF IN 21
04 Y & COLOR
16 VIDEO IN
REC FM OUT 52
REC COLOR OUT 53
12 VIDEO OUT
14 VIDEO OUT
PB FM IN 31
PB COLOR IN 34
05 PRE & REC
13 REC FM IN
12 REC COLOR IN
REC OUT 42
P.B IN 41
36 P.B FM OUT
33 P.B COLOR OUT
REC OUT 52
P.B IN 51
06 AUDIO & SERVO
123 MIC IN
114 AUDIO IN
116 AUDIO OUT
AUDIO OUT 153
AUDIO IN 151
RF CONVERTER
3 VIDEO IN
2 AUDIO IN
4 RF OUT
15 HEAD
21
22
11
12
41 42
31 32
CH-1
VIDEO HEAD
CH-2
AUDIO P/R HEAD




Key to abbreviations

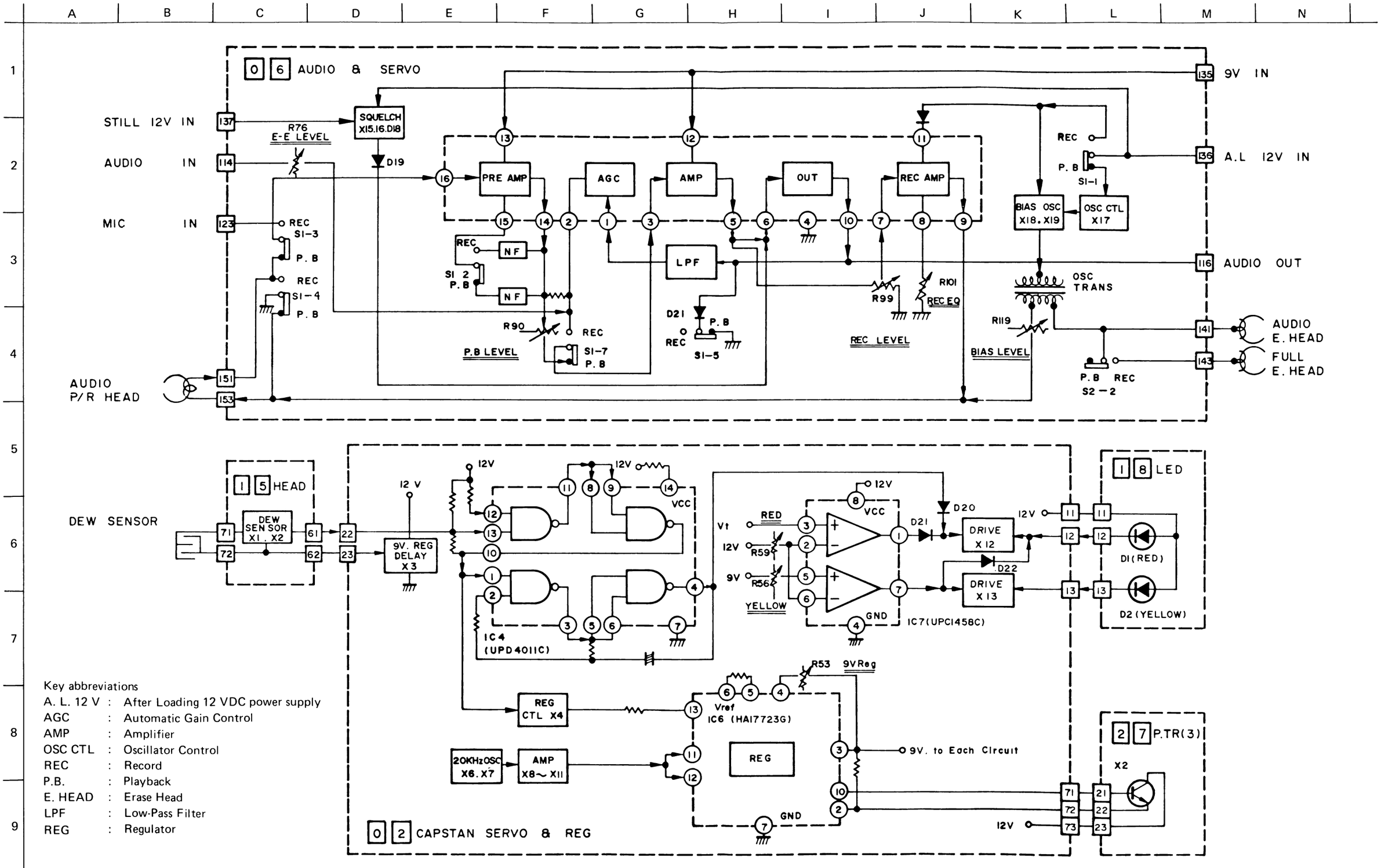
A.L. —— After Loading
U.L. —— Unloading
S. —— Still
P. —— Pause
CASS. —— Cassette
SOL. —— Solenoid
12 V E.R. —— 12 V Except Record

## 10.5 VIDEOSYSTEM BLOCK DIAGRAM



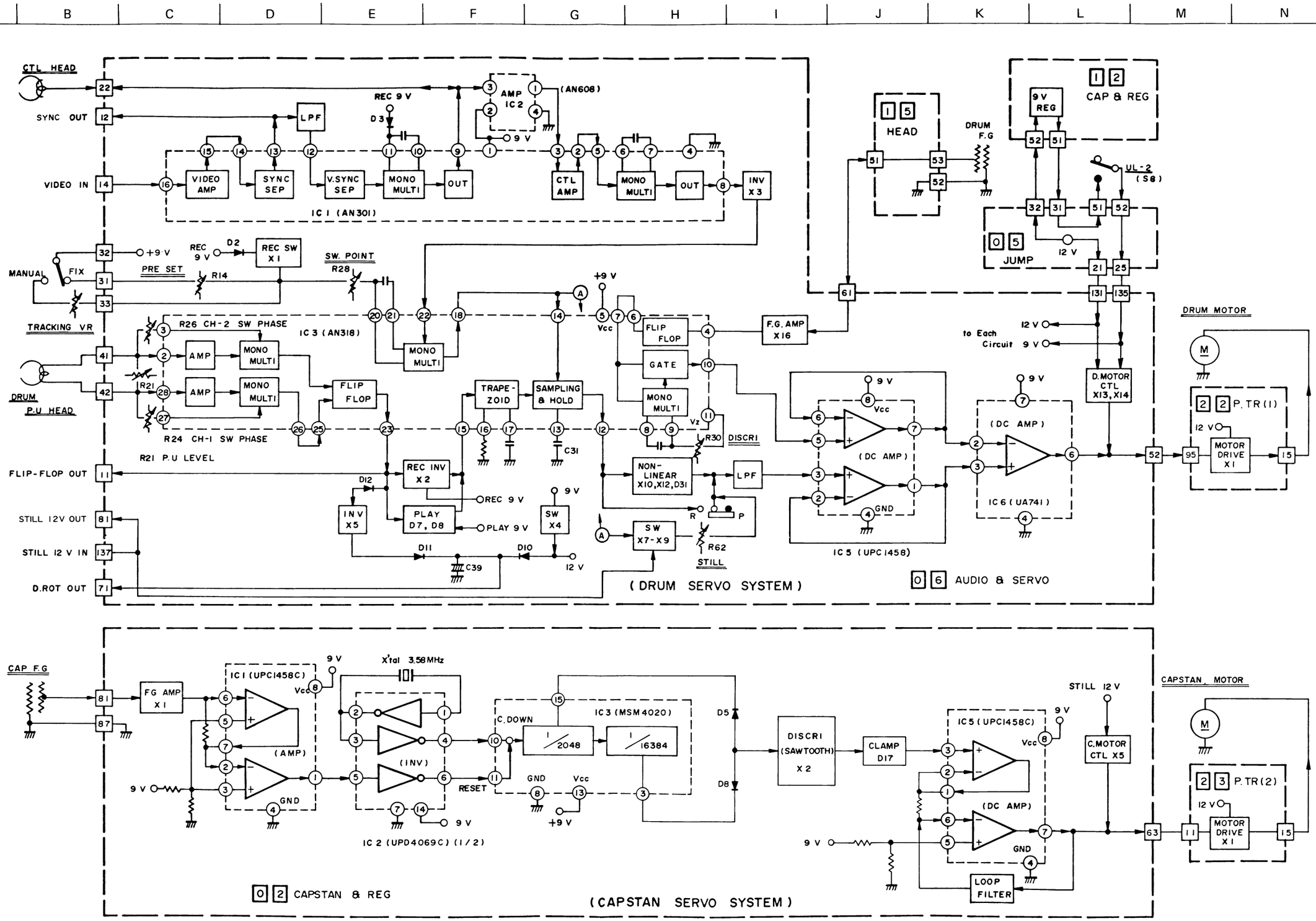

Key to abbreviations

| | | |
|---|---|---|
| ACC | : | Automatic Color Control |
| A.L. 12 V | : | After Loading power supply (12 V) |
| B.P.F. | | Band Pass Filter |
| CH. | | Channel |
| COL. | | Color |
| COMP. | | Compressor |
| CONV. | | Converter |
| DET. | | Detector |
| E.F. | | Emitter Follower |
| H.P.F. | | High Pass Filter |
| INV. | | Inverter |
| LIM. | | Limiter |
| L.P.F. | | Low Pass Filter |
| MOD. | | Modulator |
| SW. | | Electronic Switch |
| V.X.O. | | Variable Crystal Oscillator |

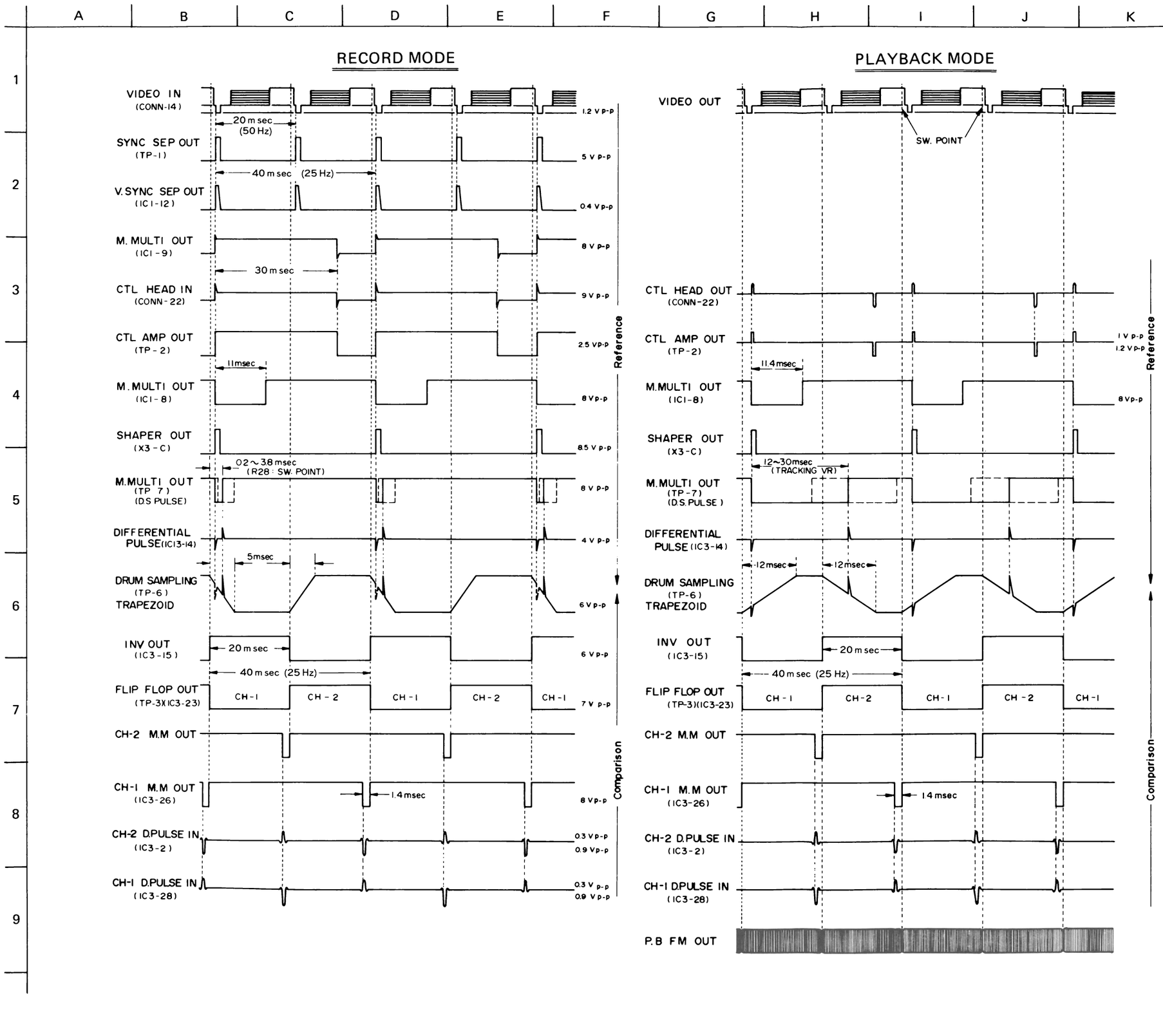



Key abbreviations

| | | |
|---|---|---|
| A. L. 12 V | : | After Loading 12 VDC power supply |
| AGC | : | Automatic Gain Control |
| AMP | : | Amplifier |
| OSC CTL | : | Oscillator Control |
| REC | : | Record |
| P.B. | : | Playback |
| E. HEAD | : | Erase Head |
| LPF | : | Low-Pass Filter |
| REG | : | Regulator |

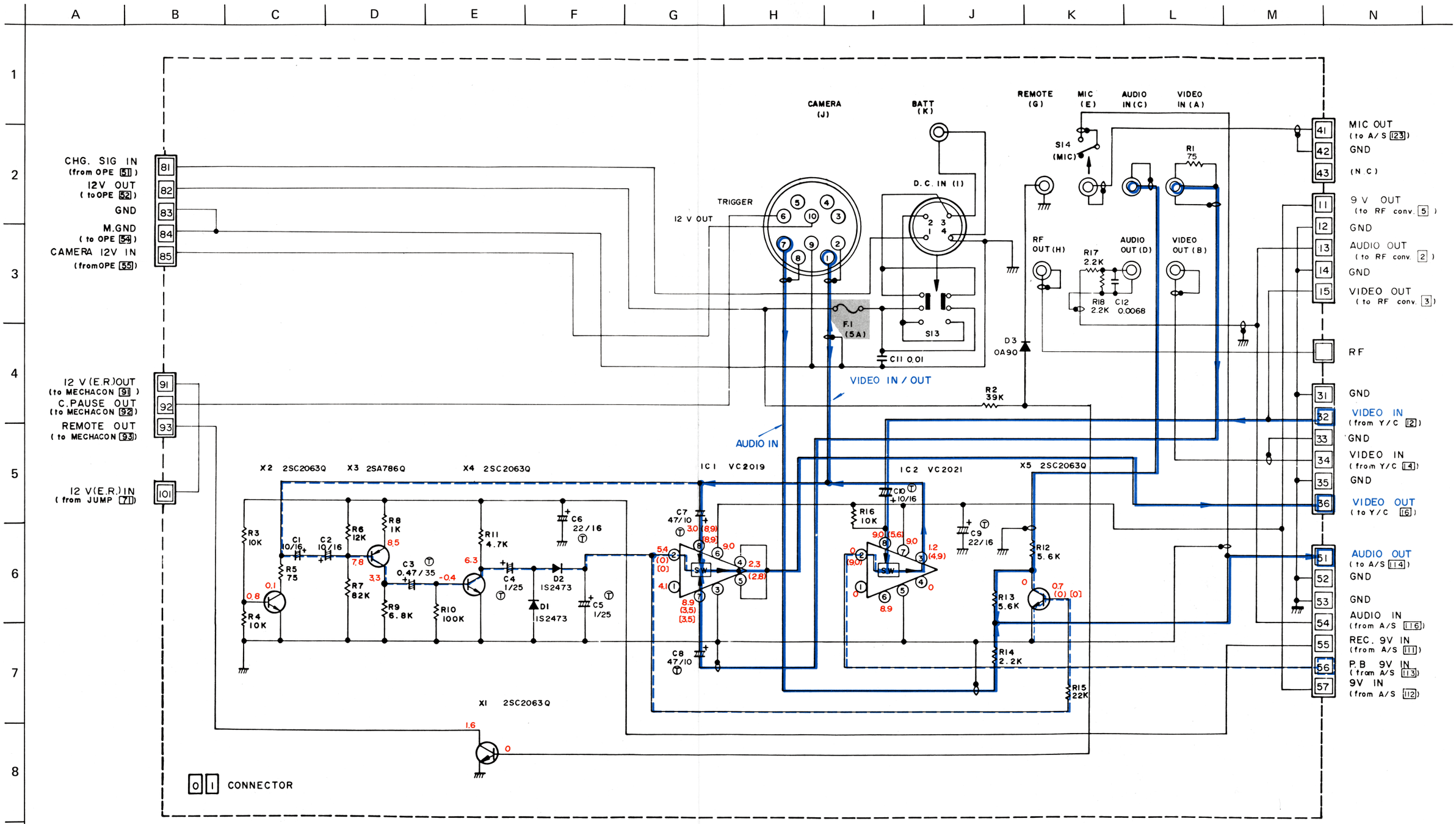

CTL HEAD
SYNC OUT
VIDEO IN
REC 9 V
D3
AMP IC2
(AN608)
LPF
VIDEO AMP
SYNC SEP
V.SYNC SEP
MONO MULTI
OUT
CTL AMP
INV X3
IC 1 (AN301)
+9 V
REC 9 V
D2
REC SW X1
SW. POINT
R28
MANUAL
FIX
PRE SET
R14
TRACKING VR
R26 CH-2 SW PHASE
IC 3 (AN318)
DRUM P.U HEAD
R21
R24 CH-1 SW PHASE
R21 P.U LEVEL
FLIP FLOP
TRAPE-ZOID
SAMPLING & HOLD
GATE
Vcc
Vz
R30
DISCRI
C31
FLIP-FLOP OUT
D12
REC INV X2
REC 9 V
PLAY D7, D8
PLAY 9 V
INV X5
SW X4
D11
D10
C39
12 V
NON-LINEAR X10,X12,D31
SW X7-X9
R62
STILL
R
P
A
STILL 12V OUT
STILL 12 V IN
D.ROT OUT
F.G. AMP X16
HEAD
DRUM F.G
9 V REG
CAP & REG
UL-2 (S8)
JUMP
12 V
to Each Circuit 9 V
D.MOTOR CTL X13, X14
DRUM MOTOR
P.TR (1)
MOTOR DRIVE X1
(DC AMP)
IC 6 (UA741)
IC 5 (UPC1458)
GND
( DRUM SERVO SYSTEM )
AUDIO & SERVO
CAP F.G
FG AMP X1
IC 1 (UPC1458C)
(AMP)
X'tal 3.58MHz
IC 2 (UPD4069C) (1/2)
(INV)
RESET
C. DOWN
IC 3 (MSM 4020)
1/2048
1/16384
D5
D8
DISCRI (SAWTOOTH) X2
CLAMP D17
IC 5 (UPC1458C)
STILL 12 V
C.MOTOR CTL X5
CAPSTAN MOTOR
P.TR (2)
LOOP FILTER
CAP & REG
( CAPSTAN SERVO SYSTEM )

## 10.8 DRUM SERVO TIMING CHART




Key to abbreviations

| | | |
|---|---|---|
| CTL | : | Control |
| V.SYNC SEP | : | Vertical Sync Separator |
| M. MULTI | : | Monostable Multivibrator |
| INV | : | Inverter |
| D. PULSE | : | Drum Pulse |
| P.B. | : | Playback |

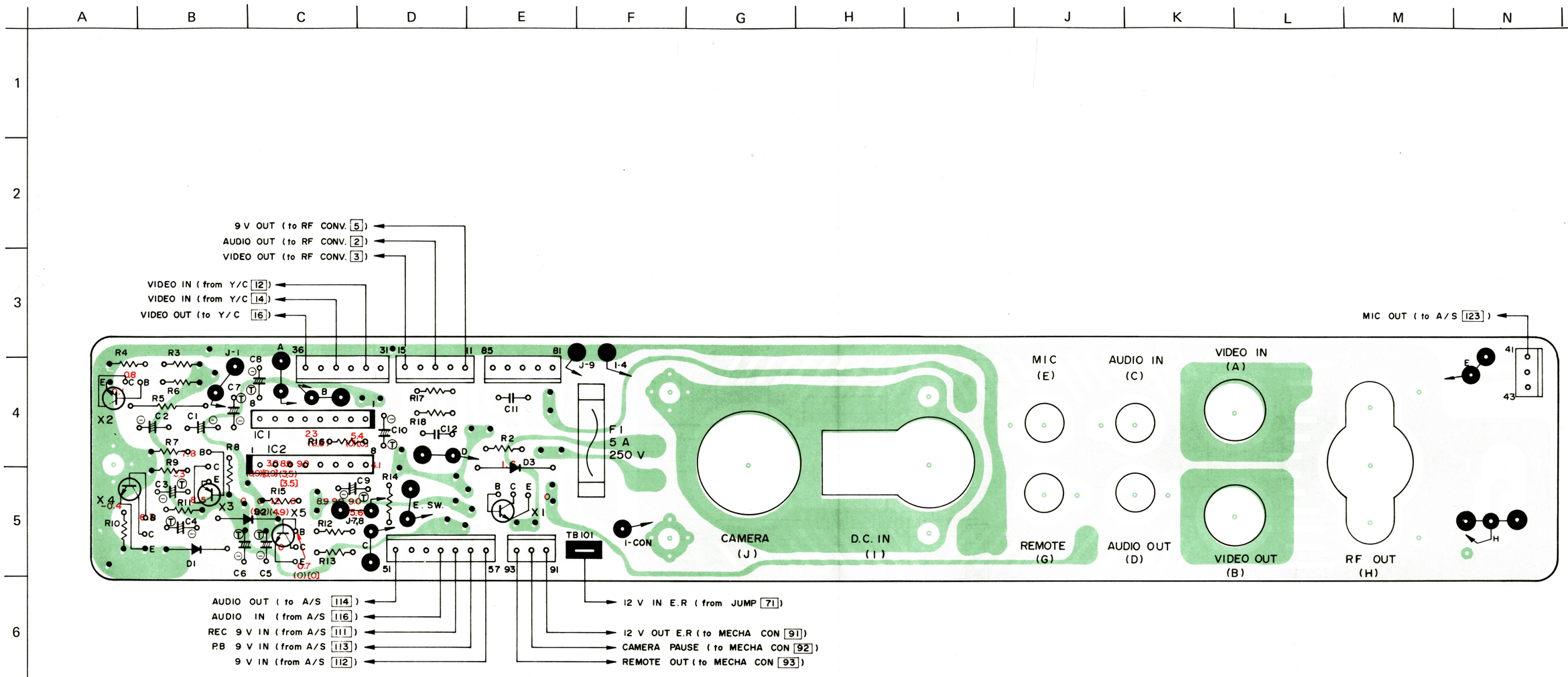



NOTE: 1. Unless otherwise specified;
All resistance values are in ohms, 1/8 W.
All capacitance values are μF.

2. All voltages are DC-measured with a V.T.V.M at record mode when operating camera normally.
( ) represents the DC voltage at playback mode.
[ ] represents the DC voltage at record mode without camera connection.

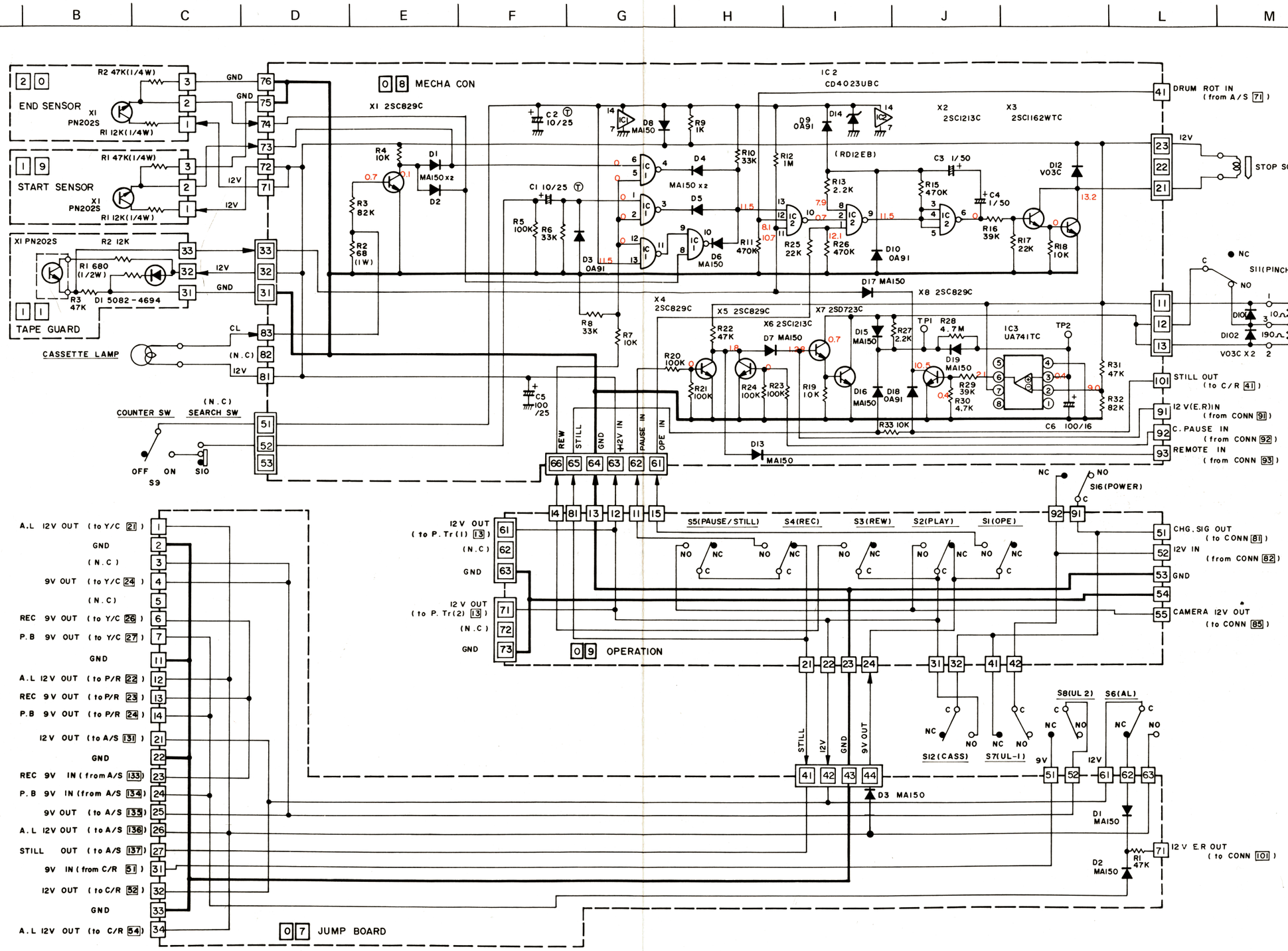
**SAFETY PRECAUTION**

**Shaded ( ) parts are critical for safety.**
**Replace only with part number specified.**


9 V OUT ( to RF CONV. 5 )
AUDIO OUT ( to RF CONV. 2 )
VIDEO OUT ( to RF CONV. 3 )
VIDEO IN ( from Y/C 12 )
VIDEO IN ( from Y/C 14 )
VIDEO OUT ( to Y/C 16 )
MIC OUT ( to A/S 123 )
MIC (E)
AUDIO IN (C)
VIDEO IN (A)
F1 5 A 250 V
IC1
IC2
X1
X2
X3
X4
X5
D1
D3
E. SW.
I-CON
CAMERA (J)
D.C. IN (I)
REMOTE (G)
AUDIO OUT (D)
VIDEO OUT (B)
RF OUT (H)
AUDIO OUT ( to A/S 114 )
AUDIO IN ( from A/S 116 )
REC 9 V IN ( from A/S 111 )
PB 9 V IN ( from A/S 113 )
9 V IN (from A/S 112 )
12 V IN E.R ( from JUMP 71 )
12 V OUT E.R ( to MECHA CON 91 )
CAMERA PAUSE ( to MECHA CON 92 )
REMOTE OUT ( to MECHA CON 93 )

NOTE: All voltages are DC-measured with a V.T.V.M
at record mode when oprating camera normally.
( ) represents the DC voltage at playback mode.
[ ] represents the DC voltage at record mode
without camera connection.

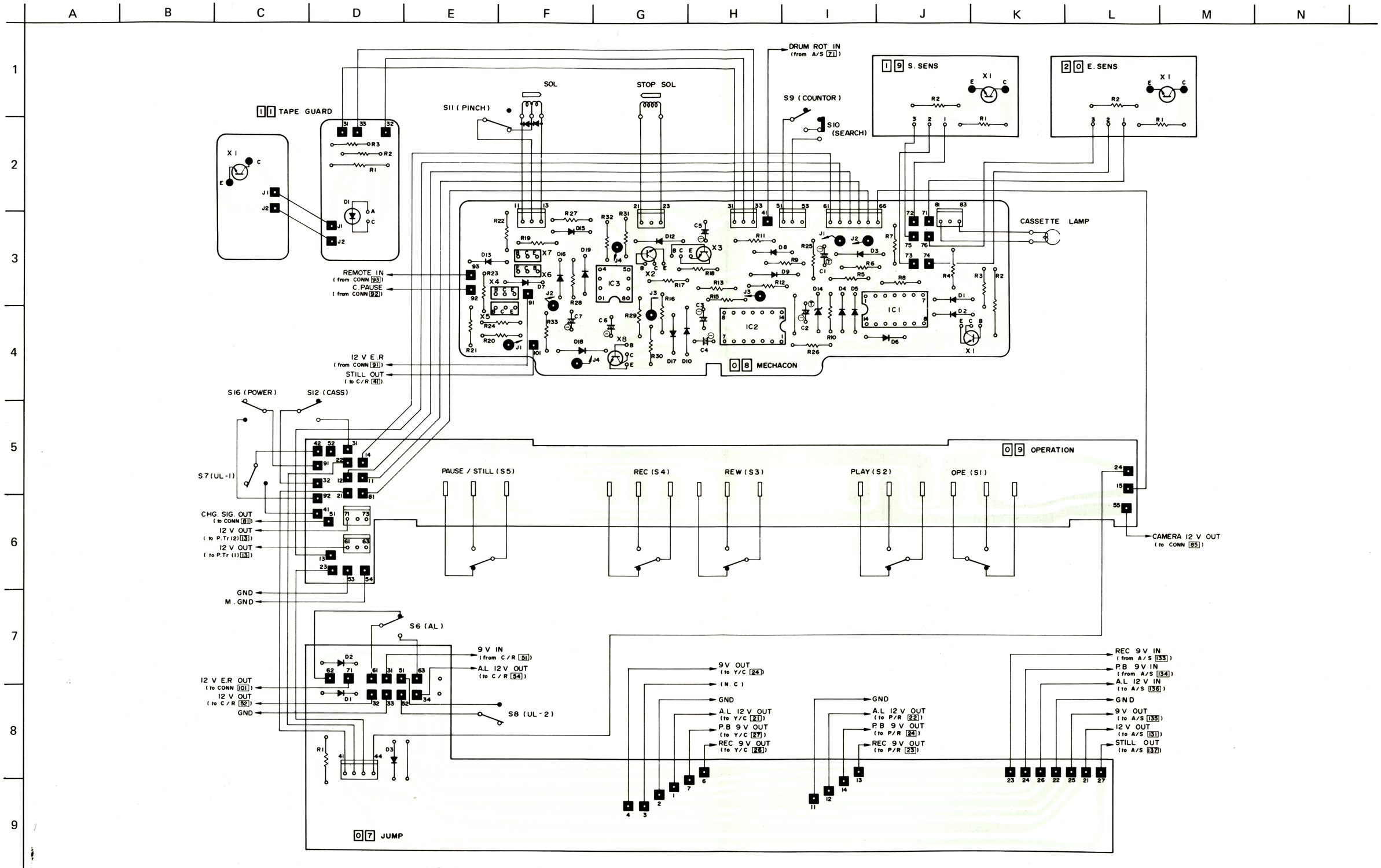
## 10.11 MECHANISM CONTROL, OPERATION AND JUMP BOARD SCHEMATIC DIAGRAM




NOTE: 1. Unless otherwise specified;
All resistance values are in ohms, 1/8 W.
All capacitance values are μF.

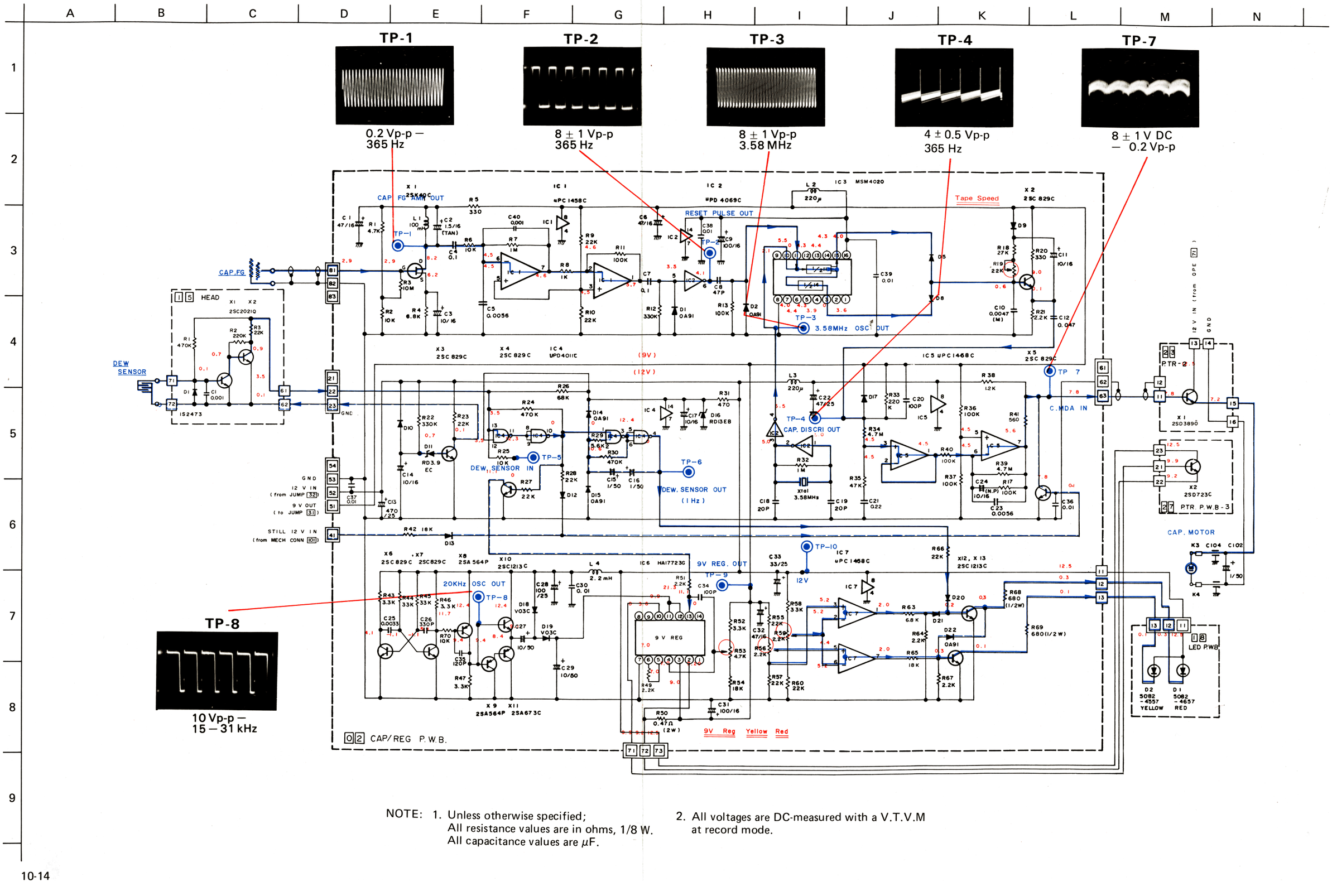
2. All voltages are DC-measured with a V.T.V.M at record mode.

## 10.12 MECHANISM CONTROL, OPERATION AND JUMP CIRCUIT BOARD


DRUM ROT IN (from A/S 71)
19 S. SENS
20 E. SENS
11 TAPE GUARD
SOL
STOP SOL
S11 ( PINCH )
S9 ( COUNTOR )
S10 (SEARCH)
CASSETTE LAMP
REMOTE IN ( from CONN 93 )
C.PAUSE ( from CONN 92 )
12 V E.R ( from CONN 91 )
STILL OUT ( to C/R 41 )
08 MECHACON
S16 (POWER)
S12 (CASS)
S7(UL-1)
09 OPERATION
PAUSE / STILL (S5)
REC (S4)
REW (S3)
PLAY (S2)
OPE (S1)
CAMERA 12 V OUT ( to CONN 65 )
CHG. SIG. OUT ( to CONN 81 )
12 V OUT ( to P.Tr (2) 13 )
12 V OUT ( to P.Tr (1) 15 )
GND
M.GND
S6 (AL)
9 V IN ( from C/R 51 )
A.L 12V OUT ( to C/R 54 )
12 V E.R OUT ( to CONN 101 )
12 V OUT ( to C/R 52 )
GND
S8 (UL-2)
9V OUT ( to Y/C 24 )
(N.C)
GND
A.L 12 V OUT ( to Y/C 21 )
P.B 9 V OUT ( to Y/C 27 )
REC 9 V OUT ( to Y/C 26 )
GND
A.L 12 V OUT ( to P/R 22 )
P.B 9 V OUT ( to P/R 24 )
REC 9 V OUT ( to P/R 23 )
REC 9 V IN ( from A/S 133 )
P.B 9V IN ( from A/S 134 )
A.L 12 V IN ( to A/S 136 )
GND
9 V OUT ( to A/S 135 )
12 V OUT ( to A/S 131 )
STILL OUT ( to A/S 137 )
07 JUMP

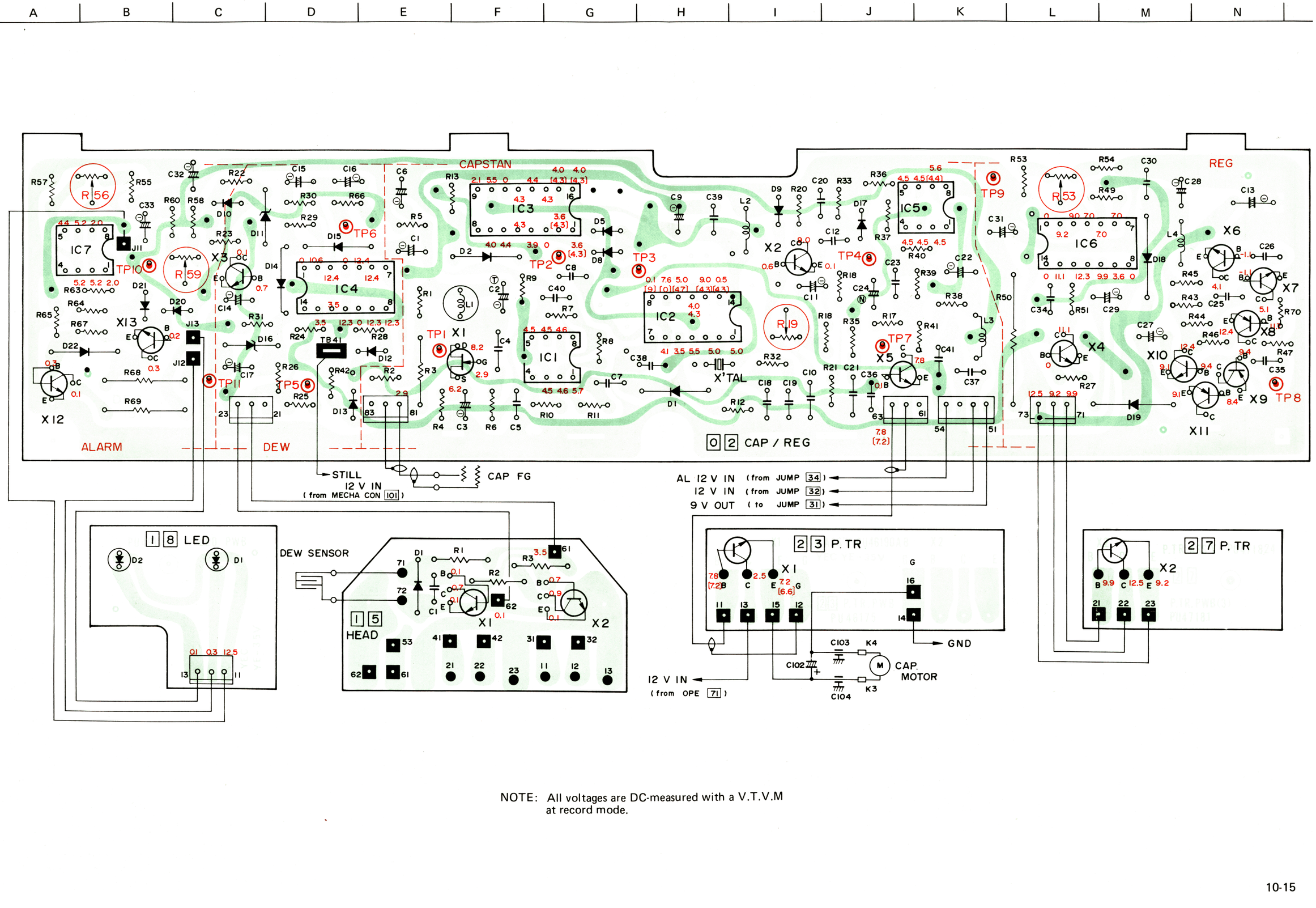
NOTE: 1. Unless otherwise specified;
All resistance values are in ohms, 1/8 W.
All capacitance values are $\mu$F.

2. All voltages are DC-measured with a V.T.V.M at record mode.
( ) represents the DC voltage at playback mode.

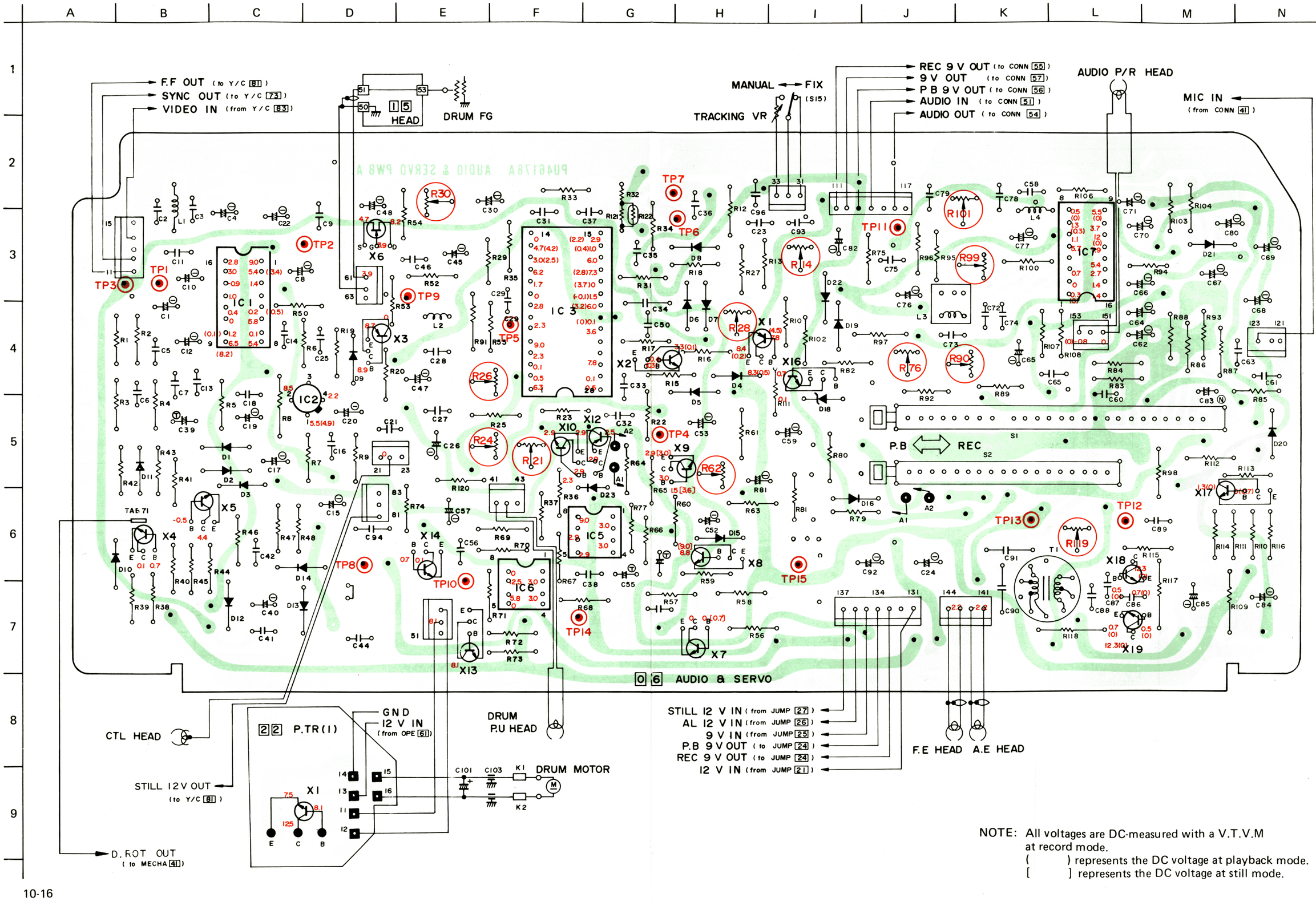



NOTE: 1. Unless otherwise specified;
All resistance values are in ohms, 1/8 W.
All capacitance values are μF.

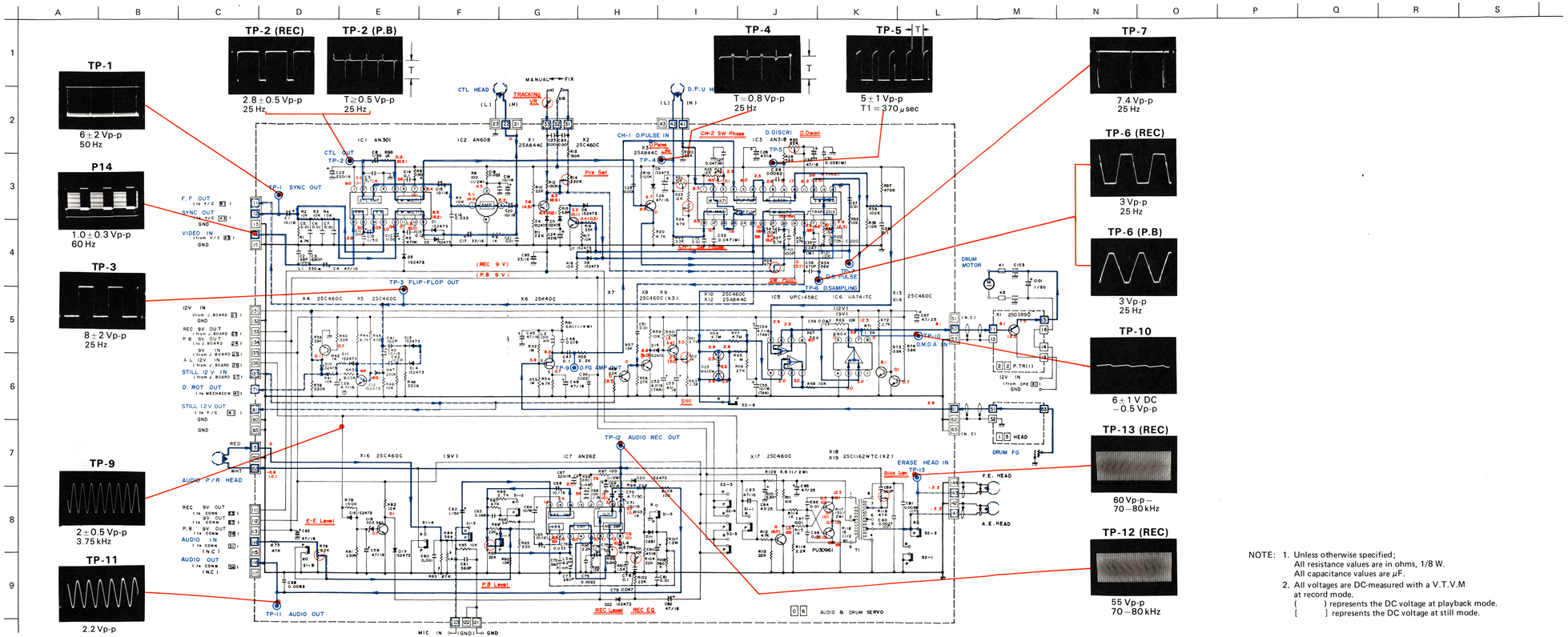
2. All voltages are DC-measured with a V.T.V.M at record mode.



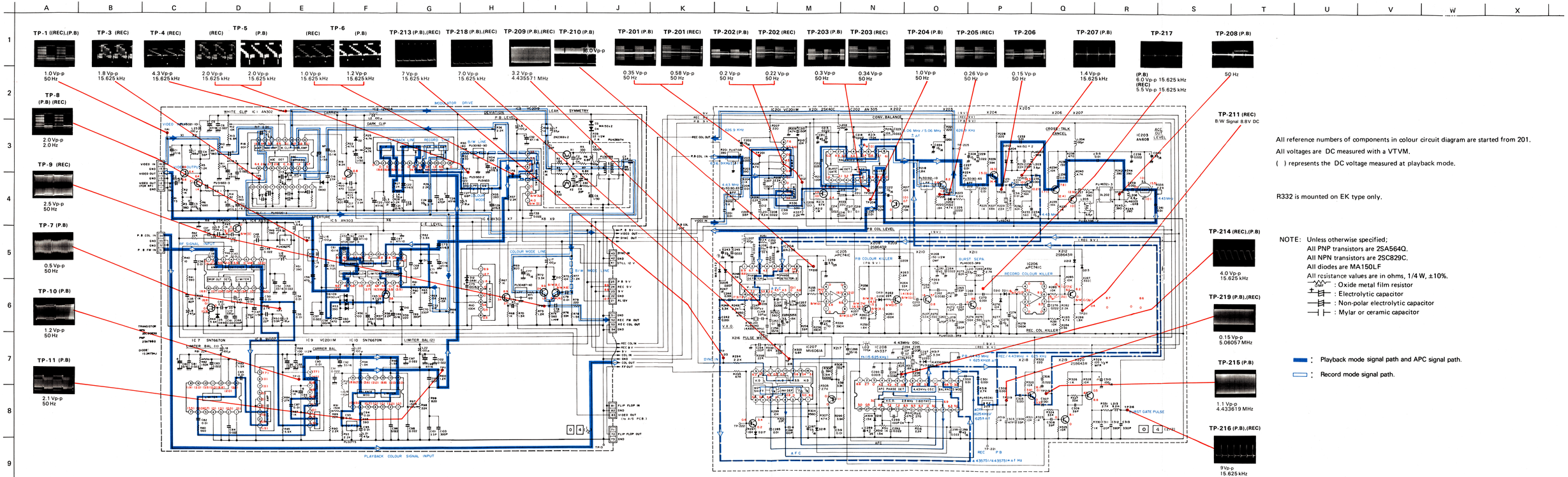

NOTE: All voltages are DC-measured with a V.T.V.M at record mode.

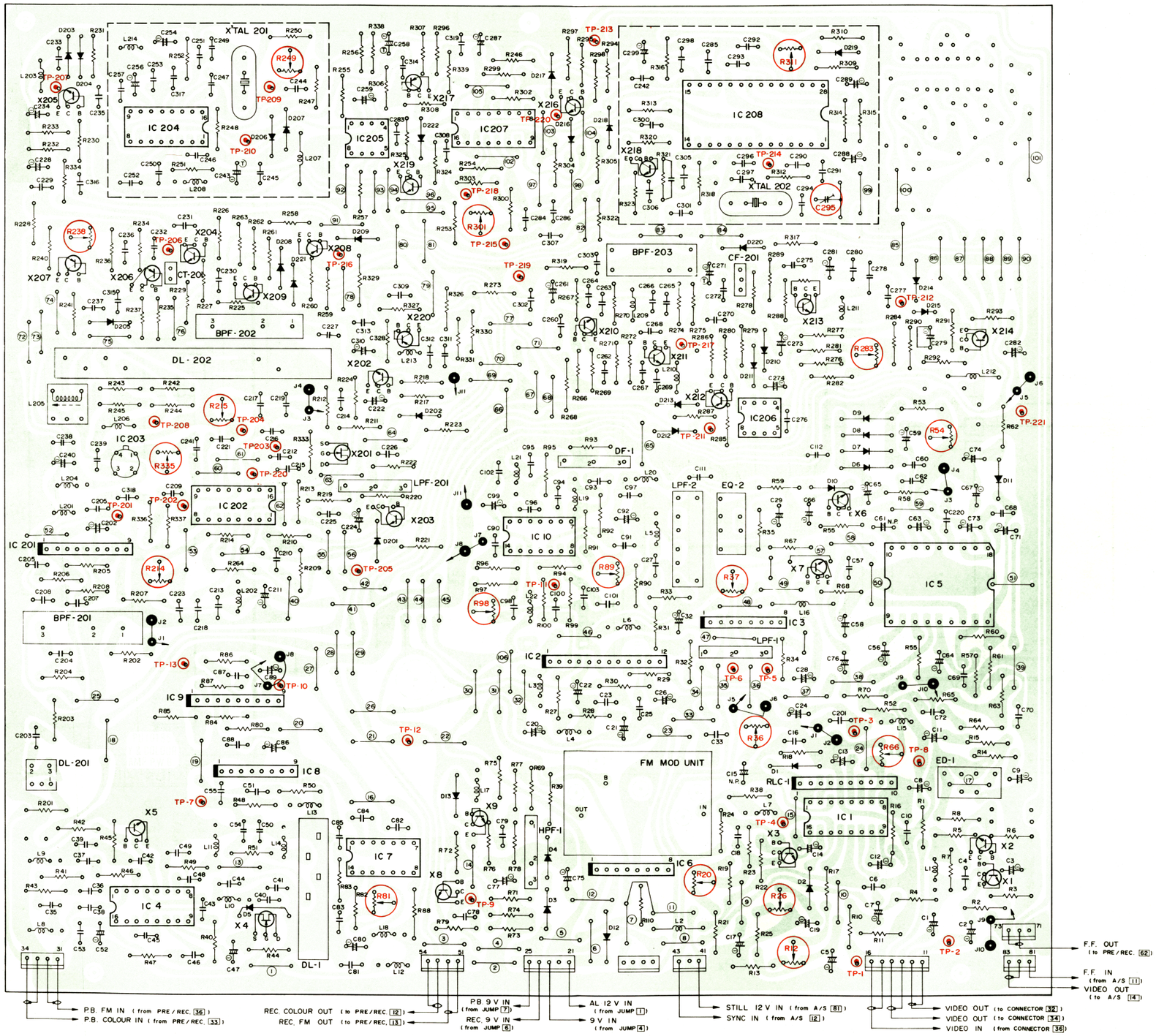


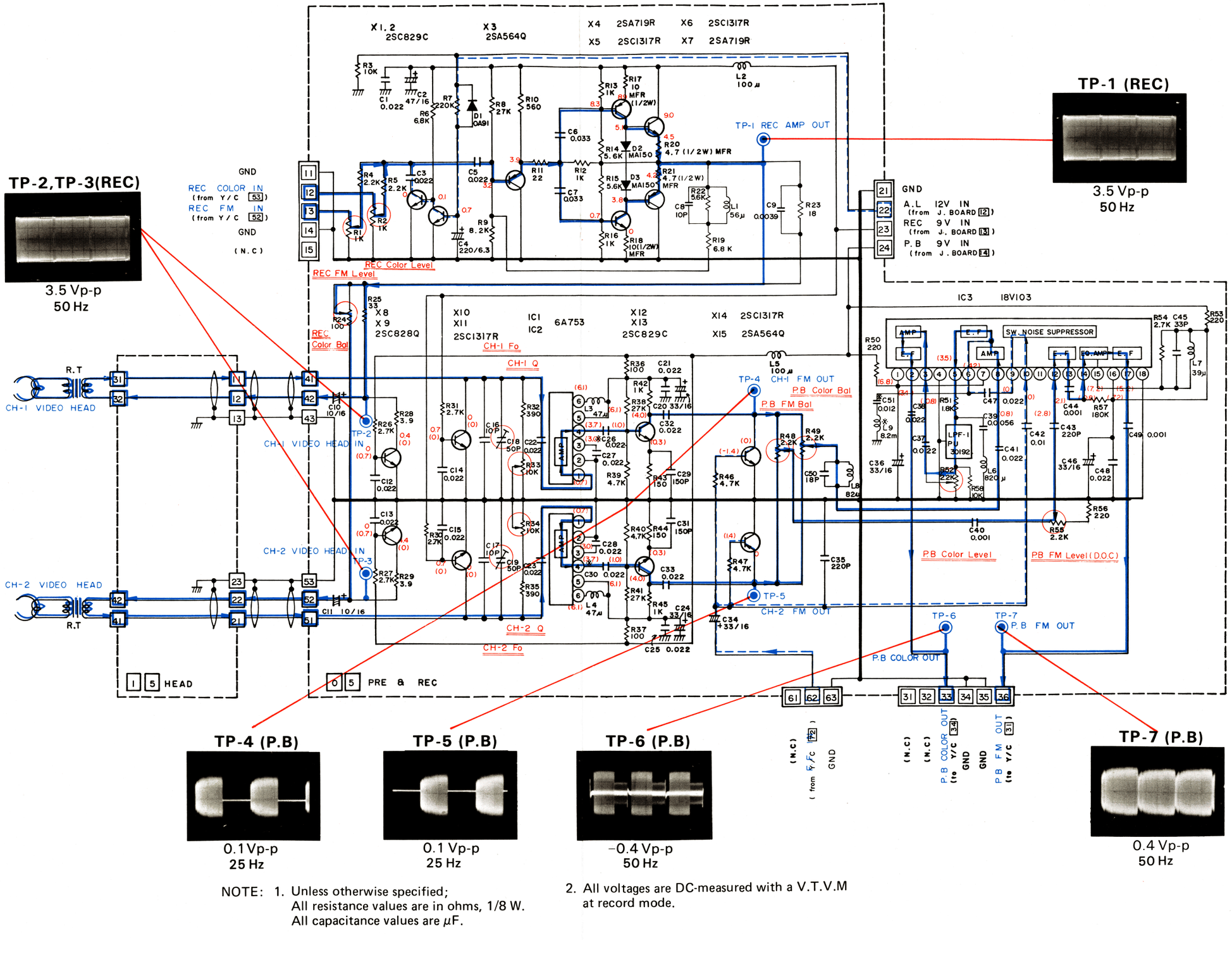

NOTE: All voltages are DC-measured with a V.T.V.M at record mode.
( ) represents the DC voltage at playback mode.
[ ] represents the DC voltage at still mode.




NOTE: 1. Unless otherwise specified;
All resistance values are in ohms, 1/8 W.
All capacitance values are μF.
2. All voltages are DC-measured with a V.T.V.M at record mode.
( ) represents the DC voltage at playback mode.
[ ] represents the DC voltage at still mode.

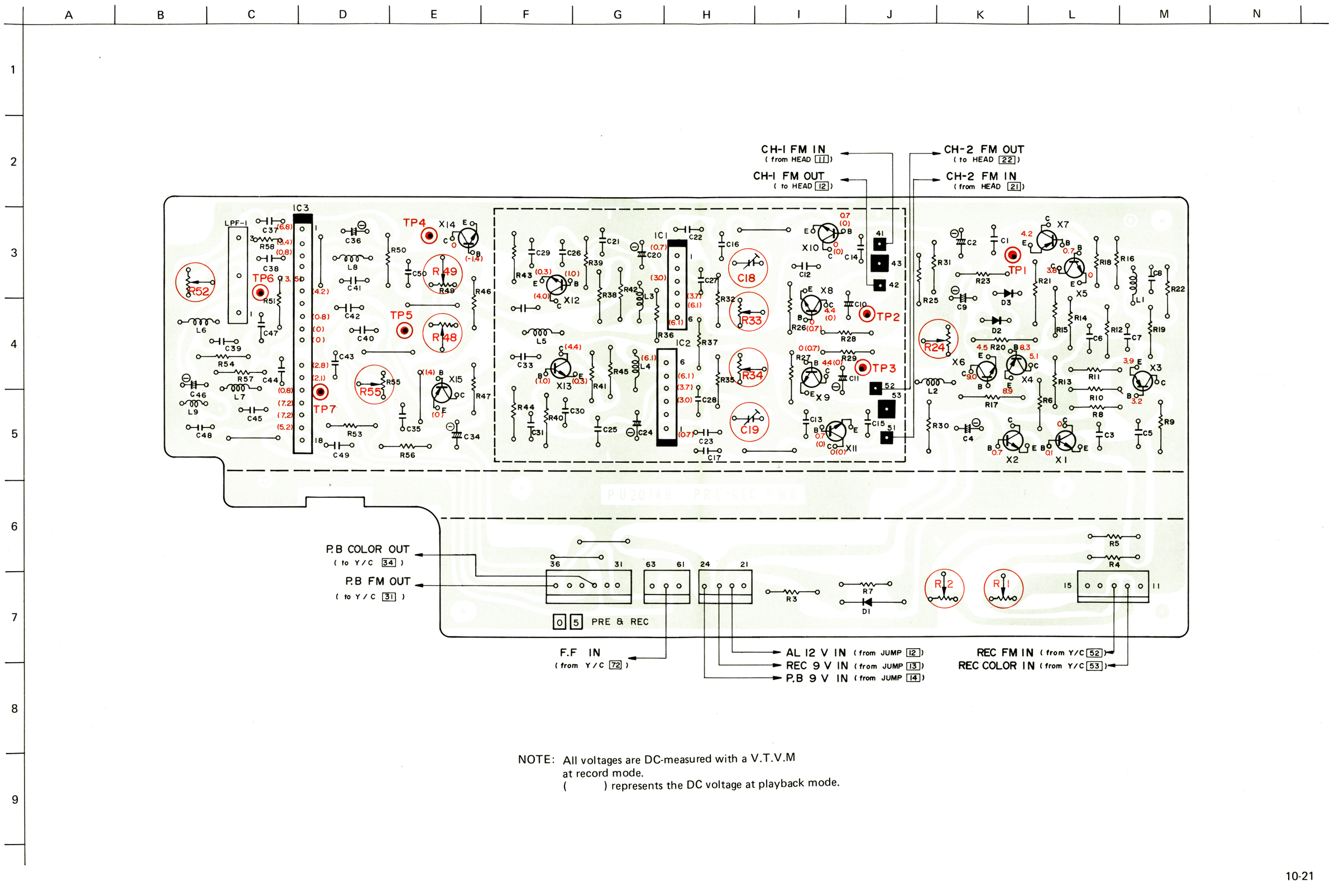

TP-1 ((REC),(P.B)
1.0 Vp-p
50 Hz
TP-3 (REC)
1.8 Vp-p
15.625 kHz
TP-4 (REC)
4.3 Vp-p
15.625 kHz
TP-5
(REC)
2.0 Vp-p
15.625 kHz
(P.B)
2.0 Vp-p
15.625 kHz
TP-6
(REC)
1.0 Vp-p
15.625 kHz
(P.B)
1.2 Vp-p
15.625 kHz
TP-213 (P.B),(REC)
7 Vp-p
15.625 kHz
TP-218 (P.B),(REC)
7.0 Vp-p
15.625 kHz
TP-209 (P.B),(REC)
3.2 Vp-p
4.435571 MHz
TP-210 (P.B)
8.0 Vp-p
TP-201 (P.B)
0.35 Vp-p
50 Hz
TP-201 (REC)
0.58 Vp-p
50 Hz
TP-202 (P.B)
0.2 Vp-p
50 Hz
TP-202 (REC)
0.22 Vp-p
50 Hz
TP-203 (P.B)
0.3 Vp-p
50 Hz
TP-203 (REC)
0.34 Vp-p
50 Hz
TP-204 (P.B)
1.0 Vp-p
50 Hz
TP-205 (REC)
0.26 Vp-p
50 Hz
TP-206
0.15 Vp-p
50 Hz
TP-207 (P.B)
1.4 Vp-p
15.625 kHz
TP-217
(P.B)
6.0 Vp-p 15.625 kHz
(REC)
5.5 Vp-p 15.625 kHz
TP-208 (P.B)
50 Hz
TP-8
(P.B) (REC)
2.0 Vp-p
2.0 Hz
TP-9 (REC)
2.5 Vp-p
50 Hz
TP-7 (P.B)
0.5 Vp-p
50 Hz
TP-10 (P.B)
1.2 Vp-p
50 Hz
TP-11 (P.B)
2.1 Vp-p
50 Hz
TP-211 (REC)
B.W Signal 8.8 V DC
TP-214 (REC),(P.B)
4.0 Vp-p
15.625 kHz
TP-219 (P.B),(REC)
0.15 Vp-p
5.06057 MHz
TP-215 (P.B)
1.1 Vp-p
4.433619 MHz
TP-216 (P.B),(REC)
9Vp-p
15.625 kHz
PLAYBACK COLOUR SIGNAL INPUT
SYNC IN
REC COLOUR SIGNAL OUTPUT
REC FM OUT
REC COL OUT
FP OUT
FLIP FLOP IN
FLIP FLOP OUT
VIDEO OUT (to A/S PCB)
CONV. BALANCE
CROSS TALK CANCEL
ACC OUT LEVEL
BURST SEPA.
RECORD COLOUR KILLER
PB COLOUR KILLER
BURST GATE PULSE
4.43MHz OSC.
AFC
APC PHASE SET
BALANCE ADJ
PB COL LEVEL
REC COL LEVEL
LIMITER BAL (1)
LIMITER BAL (2)
CARRIER BAL
APERTURE
CR LEVEL
COLOUR MODE LINE
B/W MODE LINE
MODULATOR DRIVE
DEVIATION
P.B LEVEL
SYMMETRY
WHITE CLIP
DARK CLIP
BLACK LINE
RECORD
P.B
B/W LINE
RF SIGNAL INPUT
SHOT OUT
LIMITER
IC 7 SN76670N
IC 8 AN302
IC 9 VC2011M
IC 10 SN76670N
IC 4 AN330
IC 5 AN303
IC 6 AN304
IC201 VC2001M
IC202 AN 305
IC203 AN6GB
IC204 MN6604A
IC205 μPC74C
IC206 μPC74C
IC207 MN6604A
IC208 AN337
X201 2SK40C
X202
X203
X204
X205
X206
X207
X209
X210
X211
X212 2SB643R
X213 2SD643R
X214
X216 PULSE MTR
X217
X218
X219
X220
X221
X222
X223
X224
X225
X226
X227
X228
X229
X230
X231
X232
X233
X234
X235
X236
X237
X238
X239
X240
X241
X242
X243
X244
X245
X246
X247
X248
X249
X250
X251
X252
X253
X254
X255
X256


X'TAL 201
IC 204
IC 205
IC 207
IC 208
X'TAL 202
BPF-203
CF-201
BPF-202
DL-202
DL-201
BPF-201
LPF-201
DF-1
LPF-2
EQ-2
LPF-1
HPF-1
IC 203
IC 202
IC 201
IC 10
IC 9
IC 8
IC 7
IC 6
IC 4
IC 3
IC 2
IC 1
IC 5
IC206
FM MOD UNIT
RLC-1
ED-1
CT-201
TP-201
TP-202
TP-203
TP-204
TP-205
TP-206
TP-207
TP-208
TP-209
TP-210
TP-211
TP-212
TP-213
TP-214
TP-215
TP-216
TP-217
TP-218
TP-219
TP-220
TP-221
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
TP-13
R238
R249
R335
R301
R311
R214
R215
R263
R66
R54
R37
R89
R98
R36
R12
R81
R20
R26
P.B. FM IN ( from PRE/REC. 36 )
P.B. COLOUR IN ( from PRE/REC. 33 )
REC. COLOUR OUT ( to PRE/REC. 12 )
REC. FM OUT ( to PRE/REC. 13 )
P.B. 9 V IN ( from JUMP 7 )
REC. 9 V IN ( from JUMP 6 )
AL 12 V IN ( from JUMP 1 )
9 V IN ( from JUMP 4 )
STILL 12 V IN ( from A/S 81 )
SYNC IN ( from A/S 12 )
VIDEO OUT ( to CONNECTOR 32 )
VIDEO OUT ( to CONNECTOR 34 )
VIDEO IN ( from CONNECTOR 36 )
F.F. OUT ( to PRE/REC. 62 )
F.F. IN ( from A/S 11 )
VIDEO OUT ( to A/S 14 )




NOTE: 1. Unless otherwise specified;
All resistance values are in ohms, 1/8 W.
All capacitance values are μF.

2. All voltages are DC-measured with a V.T.V.M at record mode.


CH-1 FM IN ( from HEAD 11 )
CH-1 FM OUT ( to HEAD 12 )
CH-2 FM OUT ( to HEAD 22 )
CH-2 FM IN ( from HEAD 21 )
P.B COLOR OUT ( to Y/C 34 )
P.B FM OUT ( to Y/C 31 )
05 PRE & REC
F.F IN ( from Y/C 72 )
AL 12 V IN ( from JUMP 12 )
REC 9 V IN ( from JUMP 13 )
P.B 9 V IN ( from JUMP 14 )
REC FM IN ( from Y/C 52 )
REC COLOR IN ( from Y/C 53 )
PU20749 PRE/REC PWB

NOTE: All voltages are DC-measured with a V.T.V.M at record mode.
( ) represents the DC voltage at playback mode.

# SECTION 11
# ELECTRICAL PARTS LIST

1. All abbreviations in this list are as follows:

RESISTORS – All resistance values are in ohms (Ω).

| | | |
|---|---|---|
| K | : | 1 000 |
| M | : | 1 000 000 |
| CR | : | Carbon Resistor |
| Comp. R | : | Composition Resistor |
| WR | : | Wire Wound Resistor |
| OMR | : | Oxide Metal Film Resistor |
| VR | : | Variable Resistor |
| MFR | : | Metal Film Resistor |

CAPACITORS – All capacitance values are in μF, unless otherwise indicated.

| | | |
|---|---|---|
| P | : | μμF |
| C Cap | : | Ceramic Capacitor |
| PS | : | Polystyrol Capacitor |
| MY Cap | : | Mylar Capacitor |
| MP Cap | : | Metalized Paper Capacitor |
| PC Cap | : | Polycarbonate Capacitor |
| E Cap | : | Electrolytic Capacitor |
| PP Cap | : | Poly Pro Capacitor |
| MM Cap | : | Metalized Mylar Capacitor |
| T Cap | : | Tantalum Capacitor |
| NP Cap | : | Non-Polar Capacitor |

Tolerance of resistors and capacitors is as follows:

| | | |
|---|---|---|
| M | : | ± 20 % |
| K | : | ± 10 % |
| J | : | ± 5 % |
| G | : | ± 2 % |

## 11-1 CONNECTOR ASS'Y . . . . . EG Type: PU47302C
## EK Type: PU47302B

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU20778 | Printed Board | |
| IC 1 | VC2019 | Integrated Circuit | |
| IC 2 | VC2021 | " | |
| X 1 | 2SC2063Q | Transistor | |
| X 2 | " | " | |
| X 3 | 2SA786Q | " | |
| X 4 | 2SC2063Q | " | |
| X 5 | " | " | |
| D 1 | MA150 | Diode | or 1S2473 |
| D 2 | " | " | |
| D 3 | OA90 | " | |
| R 1 | QRD141J-750 | CR | 75 ¼ W, J |
| R 2 | QRD181J-393 | " | 39 K 1/8 W, J |
| R 3 | " -103 | " | 10 K " |
| R 4 | " -103 | " | 10 K " |
| R 5 | QRD141J-750 | " | 75 ¼ W, J |
| R 6 | QRD181J-123 | " | 12 K 1/8 W, J |
| R 7 | " -823 | " | 82 K " |
| R 8 | " -102 | " | 1 K " |
| R 9 | " -682 | " | 6.8 K " |
| R10 | " -104 | " | 100 K " |
| R11 | " -472 | " | 4.7 K " |
| R12 | " -562 | " | 5.6 K " |
| R13 | " -562 | " | 5.6 K " |
| R14 | " -222 | " | 2.2 K " |
| R15 | " -223 | " | 22 K " |
| R16 | " -103 | " | 10 K " |
| R17 | " -222 | " | 2.2 K " |
| R18 | " -222 | " | 2.2 K " |
| C 1 | QEW51CA-106 | E Cap | 10 16 V |
| C 2 | " -106 | " | 10 " |
| C 3 | QEE41VM-474 | T Cap | 0.47 35 V |
| C 4 | QEE41EM-105 | " | 1 25 V |
| C 5 | " -105 | " | 1 " |
| C 6 | QEE41CM-226 | " | 22 16 V |
| C 7 | QEE41AM-476 | " | 47 10 V |
| C 8 | " -476 | " | 47 " |
| C 9 | QEE41CM-226 | " | 22 16 V |
| C10 | " -106 | " | 10 " |
| C11 | QCF11HP-103 | C Cap | 0.01 50 V |
| C12 | QFM41HK-682 | MY Cap | 0.0068 " |
| Conn A | PU47377-3 | BNC Connector | for VIDEO IN |
| Conn B | " -3 | " | for VIDEO OUT |
| Conn C | QMS3501-010 | Jack Ass'y | for AUDIO IN |
| Conn D | " -010 | " | for AUDIO OUT |
| Conn E | QMS3503-003 | " | for MIC IN |
| Conn F | – | – | |
| Conn G | QMS3501-010 | Jack Ass'y | for REMote Control |
| Conn H | PU46471 | Aerial Socket | for RF OUT (EG Type) |
| | A75937 | " | for RF OUT (EK Type) |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| Conn I | QMC9016-002 | 4P DIN Socket | for DC IN |
| Conn J | GU45801 | 10P Socket | for CAMERA |
| Conn K | QMA1221-001 | E.B. Jack Ass'y | for BATTery |
| | PU43351-3 | Cap. Housing | |
| | " -5 | " | |
| | " -6 | " | |
| | " -7 | " | |
| | A74017 | Tab | |
| | QMF51A2-5R0 | Fuse | |
| | PU47305 | Spacer | for RF (EK Type Only) |
| | SPSP3006NS | Screw | EG Type |
| | SPSP3010NS | " | EK Type |
| | SPSP3008NS | " | |
| | WLS3000N | Lock Washer | |
| | A44594-001 | Fuse Clip | |
| | PU47281 | Connector Panel | |

## 11-2 CAPSTAN/REGULATOR PRINTED CIRCUIT BOARD ASS'Y . . . . . PU46181B (EG/EK Type)

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU20630-2 | Printed board | |
| IC 1 | UPC1458C | Integrated Circuit | |
| IC 2 | UPD4069C | " | |
| IC 3 | MSM4020 | " | |
| IC 4 | UPD4011C | " | |
| IC 5 | UPC1458C | " | |
| IC 6 | HA17723G | " | |
| IC 7 | UPC1458C | " | |
| X 1 | 2SK40C | F.E.T. | |
| X 2 | 2SC829C | Transistor | |
| X 3 | " | " | |
| X 4 | " | " | |
| X 5 | " | " | |
| X 6 | " | " | |
| X 7 | " | " | |
| X 8 | 2SA564P | " | |
| X 9 | " | " | |
| X10 | 2SC1213C | " | |
| X11 | 2SA673C | " | |
| X12 | 2SC1213C | " | |
| X13 | " | " | |
| D 1 | OA91 | Diode | |
| D 2 | " | " | |
| D 3 | — | — | |
| D 4 | — | — | |
| D 5 | MA150LF | Diode | |
| D 6 | — | — | |
| D 7 | — | — | |
| D 8 | MA150LF | Diode | |
| D 9 | " | " | |
| D10 | " | " | |
| D11 | RD3.9EC | Zener Diode | |
| D12 | MA150LF | Diode | |
| D13 | " | " | |
| D14 | OA91 | " | |
| D15 | " | " | |
| D16 | RD13EB | Zener Diode | |
| D17 | MA150LF | Diode | |
| D18 | VO3C | " | |
| D19 | " | " | |
| D20 | MA150LF | " | |
| D21 | " | " | |
| D22 | OA91 | " | |
| R 1 | QRD143K-472 | CR | 4.7 K 1/4 W, K |
| R 2 | " -103 | " | 10 K " |
| R 3 | QRC142K-106 | Comp. R | 10 M " |
| R 4 | QRD143K-682 | CR | 6.8 K " |
| R 5 | " -331 | " | 330 " |
| R 6 | " -103 | " | 10 K " |
| R 7 | " -105 | " | 1 M " |
| R 8 | " -102 | " | 1 K " |
| R 9 | " -223 | " | 22 K " |
| R10 | " -223 | " | 22 K " |
| R11 | " -104 | " | 100 K " |
| R12 | " -334 | " | 330 K " |
| R13 | " -104 | " | 100 K " |
| R14 | — | — | — |
| R15 | — | — | — |
| R16 | — | — | — |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R17 | QRD143K-104 | CR | 100 K 1/4 W, K |
| R18 | " -273 | " | 27 K " |
| R19 | QVZ3501-223 | VR | 22 K |
| R20 | QRD143K-331 | CR | 330 1/4 W, K |
| R21 | " -222 | " | 2.2 K " |
| R22 | " -334 | " | 330 K " |
| R23 | " -223 | " | 22 K " |
| R24 | " -474 | " | 470 K " |
| R25 | " -103 | " | 10 K " |
| R26 | " -683 | " | 68 K " |
| R27 | " -223 | " | 22 K " |
| R28 | " -223 | " | 22 K " |
| R29 | " -562 | " | 5.6 K " |
| R30 | " -474 | " | 470 K " |
| R31 | " -471 | " | 470 " |
| R32 | " -105 | " | 1 M " |
| R33 | " -224 | " | 220 K " |
| R34 | " -475 | " | 4.7 M " |
| R35 | " -473 | " | 47 K " |
| R36 | " -104 | " | 100 K " |
| R37 | " -104 | " | 100 K " |
| R38 | " -122 | " | 1.2 K " |
| R39 | " -475 | " | 4.7 M " |
| R40 | " -104 | " | 100 K " |
| R41 | " -561 | " | 560 " |
| R42 | -183 | " | 18 K " |
| R43 | " -332 | " | 3.3 K " |
| R44 | " -333 | " | 33 K " |
| R45 | " -333 | " | 33 K " |
| R46 | " -332 | " | 3.3 K " |
| R47 | " -332 | " | 3.3 K " |
| R48 | – | – | |
| R49 | QRD143K-222 | CR | 2.2 K 1/4 W, K |
| R50 | QRF021K-R47 | UR | 0.47 2 W, K |
| R51 | QRD143K-222 | CR | 2.2 K 1/4 W, K |
| R52 | " -332 | " | 3.3 K " |
| R53 | QVP4OAB-472 | VR | 4.7 K |
| R54 | QRD143K-183 | CR | 18 K 1/4 W, K |
| R55 | " -223 | " | 22 K " |
| R56 | QVP4AOB-222 | VR | 2.2 K |
| R57 | QRD143K-223 | CR | 22 K 1/4 W, K |
| R58 | " -333 | " | 33 K " |
| R59 | QVP4AOB-222 | VR | 2.2 K |
| R60 | QRD143K-223 | CR | 22 K 1/4 W, K |
| R61 | – | – | |
| R62 | – | – | |
| R63 | QRD143K-682 | CR | 6.8 K 1/4 W, K |
| R64 | " -222 | " | 2.2 K " |
| R65 | " -183 | " | 18 K " |
| R66 | " -223 | " | 22 K " |
| R67 | " -222 | " | 2.2 K " |
| R68 | QRD121K-681 | " | 680 1/2 W, K |
| R69 | " -681 | " | 680 " |
| R70 | QRD143K-103 | " | 10 K 1/4 W, K |
| C 1 | QEW51CA-476 | E Cap | 47 16 V |
| C 2 | QEE41CM-155 | T Cap | 1.5 " |
| C 3 | QEW51CA-106 | E Cap | 10 " |
| C 4 | QFM41HK-104 | MY Cap | 0.1 50 V |
| C 5 | " -562 | " | 0.0056 " |
| C 6 | QEW51CA-476 | E Cap | 47 16 V |
| C 7 | QFM41HK-104 | MY Cap | 0.1 50 V |
| C 8 | QCS31HJ-470 | C Cap | 47 P " |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| C 9 | QEW51CA-107 | E Cap | 100 16 V |
| C10 | QFM71HJ-472 | MY Cap | 0.0047 50 V |
| C11 | QEW51CA-106 | E Cap | 10 16 V |
| C12 | QFM41HK-473 | MY Cap | 0.047 50 V |
| C13 | QEW51EA-477 | E Cap | 470 25 V |
| C14 | QEW51CA-106 | " | 10 16 V |
| C15 | QEW51HA-105 | " | 1 50 V |
| C16 | " -105 | " | 1 " |
| C17 | QEW51CA-106 | " | 10 16 V |
| C18 | QCS31HJ-200 | C Cap | 20 P 50 V |
| C19 | " -200 | " | 20 P " |
| C20 | " -101 | " | 100 P " |
| C21 | QFM41HK-224 | MY Cap | 0.22 " |
| C22 | QEW51EA-476 | E Cap | 47 25 V |
| C23 | QFM41HK-562 | MY Cap | 0.0056 50 V |
| C24 | QEN41CM-106 | NP Cap | 10 16 V |
| C25 | QFM41HK-332 | MY Cap | 0.0033 50 V |
| C26 | QCS31HJ-331 | C Cap | 330 P " |
| C27 | QEW51HA-106 | E Cap | 10 " |
| C28 | QEW51EA-107 | " | 100 25 V |
| C29 | QEW51HA-106 | " | 10 50 V |
| C30 | QCF31HP-103 | C Cap | 0.01 " |
| C31 | QEW51CA-107 | E Cap | 100 16 V |
| C32 | " -476 | " | 47 " |
| C33 | QEW51EA-336 | " | 33 25 V |
| C34 | QCS31HJ-101 | C Cap | 100 P 50 V |
| C35 | " -121 | " | 120 P " |
| C36 | QCF31HP-103 | " | 0.01 " |
| C37 | " -103 | " | 0.01 " |
| C38 | " -103 | " | 0.01 " |
| C39 | " -103 | " | 0.01 " |
| C40 | QFM41HK-102 | MY Cap | 0.001 " |
| C41 | QCF31HP-103 | C Cap | 0.01 " |
| L 1 | PU44041-104 | Choke Coil | |
| L 2 | A04096-220 | Peaking Coil | |
| L 3 | " -220 | " | |
| L 4 | " -2200 | " | |
| | PU30832-1M | Crystal | 3.58 MHz |
| | A74138-1 | Pin | Test Point |
| | PU43351-3 | Cap. Housing | Conn. 2, 6, 8, 7 |
| | " -4 | " | Conn. 5 |
| | A74017 | Tab | Conn. 4 |

## 11-3 LUMINANCE/CHROMINANCE (Y/C) CIRCUIT BOARD ASS'Y . . . . . EG Type: PU47178C
EK Type: PU47178D

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| IC 1 | AN302 | Integrated Circuit | |
| IC 2 | 12V104 | " | |
| IC 3 | VC2019 | " | |
| IC 4 | AN316 | " | |
| IC 5 | AN303 | " | |
| IC 6 | 8V301 | " | |
| IC 7 | SN76670N | " | |
| IC 8 | 9V107 | " | |
| IC 9 | VC2011M | " | |
| IC10 | SN76670N | " | |
| IC201 | VC2011M | Integrated Circuit | |
| IC202 | AN305 | " | |
| IC203 | AN608 | " | |
| IC204 | AN236 | " | |
| IC205 | UPC741C | " | |
| IC206 | " | " | |
| IC207 | MN6061A | " | |
| IC208 | AN337 | " | |
| X 1 | 2SC2063Q | Transistor | |
| X 2 | " | " | |
| X 3 | " | " | |
| X 4 | 2SK40C | F.E.Transistor | |
| X 5 | 2SC2063Q | Transistor | |
| X 6 | " | " | |
| X 7 | " | " | |
| X 8 | " | " | |
| X 9 | " | " | |
| X201 | 2SK40C | F.E. Transistor | |
| X202 | 2SC2063Q | Transistor | |
| X203 | " | " | |
| X204 | " | " | |
| X205 | " | " | |
| X206 | 2SA786Q | " | |
| X207 | " | " | |
| X208 | 2SB643R | " | |
| X209 | 2SC2063Q | " | |
| X210 | " | " | |
| X211 | " | " | |
| X212 | 2SB643R | " | |
| X213 | 2SC2063Q | " | EG Type only |
| X214 | 2SD639S | " | EG Type only |
| X215 | – | – | |
| X216 | 2SC2063Q | Transistor | |
| X217 | 2SD786Q | " | |
| X218 | 2SC2063Q | " | |
| X219 | " | " | |
| X220 | 2SB643R | " | |
| D 1 | OA90 | Diode | |
| D 2 | 1S2473HJ | " | |
| D 3 | MA150 | " | |
| D 4 | " | " | |
| D 5 | OA90 | " | |
| D 6 | " | " | |
| D 7 | " | " | |
| D 8 | " | " | |
| D 9 | " | " | |
| D10 | 1S2473HJ | " | |
| D11 | " | " | |
| D12 | OA91 | " | |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| D13 | 1S2473HJ | Diode | |
| D201 | 1S2473HJ | Diode | |
| D202 | " | " | |
| D203 | MA150 | " | |
| D204 | " | " | |
| D205 | 1S2473HJ | " | (EG Type only) |
| D206 | MA150 | " | |
| D207 | " | " | |
| D208 | 0A91 | " | |
| D209 | 1S2473HJ | " | |
| D210 | " | " | |
| D211 | " | " | |
| D212 | " | " | |
| D213 | " | " | |
| D214 | " | " | (EG Type only) |
| D215 | MA26T-A | " | (EG Type only) |
| D216 | 1S2473HJ | " | (EG Type only) |
| D217 | " | " | |
| D218 | " | " | |
| D219 | " | " | |
| D220 | " | " | |
| D221 | " | " | (EG Type only) |
| D222 | " | " | (EG Type only) |
| R 1 | QRD187J-750 | CR | 75 1/8 W, J |
| R 2 | " -102 | " | 1 K " |
| R 3 | " -561 | " | 560 " |
| R 4 | – | – | – – |
| R 5 | QRD187J-122 | CR | 1.2 K 1/8 W, J |
| R 6 | " -681 | " | 680 " |
| R 7 | " -561 | " | 560 " |
| R 8 | " -560 | " (EG Type) | 56 " |
| | " -470 | " (EK Type) | 47 " |
| R 9 | – | – | |
| R10 | QRD187J-102 | CR | 1 K 1/8 W, J |
| R11 | " -152 | " | 1.5 K " |
| R12 | QVP4A0B-103 | VR | 10 K |
| R13 | QRD187J-682 | CR | 6.8 K 1/8 W, J |
| R14 | " -820 | " (EG Type) | 82 " |
| | " -101 | " (EK Type) | 100 " |
| R15 | " -561 | " | 560 " |
| R16 | " -184 | " | 180 K " |
| R17 | " -332 | " | 3.3 K " |
| R18 | " -473 | " | 47 K " |
| R19 | " -822 | " | 8.2 K " |
| R20 | QVP4A0B-471 | VR | 470 |
| R21 | QRD187J-821 | CR | 8.2 K 1/8 W, J |
| R22 | " -472 | " | 4.7 K " |
| R23 | " -472 | " | 4.7 K " |
| R24 | " -392 | " | 3.9 K " |
| R25 | " -472 | " | 4.7 K " |
| R26 | QVP4A0B-472 | VR | 4.7 K |
| R27 | QRD187J-122 | CR | 1.2 K 1/8 W, J |
| R28 | " -122 | " | 1.2 K " |
| R29 | " -222 | " | 2.2 K " |
| R30 | QRD141K-181 | " | 180 1/4 W, K |
| R31 | QRD187J-121 | " | 120 1/8 W, J |
| R32 | " -331 | " | 330 " |
| R33 | " -271 | " | 270 " |
| R34 | " -331 | " | 330 " |
| R35 | " -391 | " | 390 " |
| R36 | QVP4A0B-222 | VR | 2.2 K |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R37 | QVP4A0B-222 | VR | 2.2 K |
| R38 | QRD187J-102 | CR | 1 K 1/8 W, J |
| R39 | QRZ0047-220 | Fusible R | 22 1/2 W |
| R40 | QRD187J-100 | CR | 10 1/8 W, J |
| R41 | " -391 | " | 390 " |
| R42 | " -223 | " | 22 K " |
| R43 | " -102 | " | 1 K " |
| R44 | " -562 | " | 5.6 K " |
| R45 | " -102 | " | 1 K " |
| R46 | " -102 | " | 1 K " |
| R47 | " -152 | " | 1.5 K " |
| R48 | " -272 | " | 2.7 K " |
| R49 | " -391 | " | 390 " |
| R50 | " -392 | " | 3.9 K " |
| R51 | " -391 | " | 390 " |
| R52 | " -470 | " | 47 " |
| R53 | " -391 | " | 390 " |
| R54 | QVP4A0B-471 | VR | 470 |
| R55 | QRD187J-474 | CR | 470 K 1/8 W, J |
| R56 | " -101 | " | 100 " |
| R57 | " -104 | " | 100 K " |
| R58 | " -222 | " | 2.2 K " |
| R59 | " -221 | " | 220 " |
| R60 | " -102 | " | 1 K " |
| R61 | " -102 | " | 1 K " |
| R62 | " -332 | " | 3.3 K " |
| R63 | " -182 | " | 1.8 K " |
| R64 | " -153 | " | 15 K " |
| R65 | " -153 | " | 15 K " |
| R66 | QVP4A0B-102 | VR | 1 K |
| R67 | QRD187J-102 | CR | 1 K 1/8 W, J |
| R68 | " -102 | " | 1 K " |
| R69 | " -821 | " | 820 " |
| R70 | " -152 | " | 1.5 K " |
| R71 | " -121 | " | 120 " |
| R72 | " -332 | " | 3.3 K " |
| R73 | " -122 | " | 1.2 K " |
| R74 | QRD141K-561 | " | 560 1/4 W, K |
| R75 | QRD187J-103 | " | 10 K 1/8 W, J |
| R76 | " -333 | " | 33 K " |
| R77 | " -122 | " | 1.2 K " |
| R78 | " -152 | " | 1.5 K " |
| R79 | " -221 | " | 220 " |
| R80 | " -561 | " | 560 " |
| R81 | QVP4A0B-223 | VR | 22 K |
| R82 | QRD187J-154 | CR | 150 K 1/8 W, J |
| R83 | " -152 | " | 1.5 K " |
| R84 | " -273 | " | 27 K " |
| R85 | " -562 | " | 5.6 K " |
| R86 | " -102 | " | 1 K " |
| R87 | " -102 | " | 1 K " |
| R88 | QRG126J-101 | OMF R | 100 " |
| R89 | QVP4A0B-223 | VR | 22 K |
| R90 | QRD187J-222 | CR | 2.2 K 1/8 W, J |
| R91 | " -154 | " | 150 K " |
| R92 | " -102 | " | 1 K " |
| R93 | " -222 | " | 2.2 K " |
| R94 | " -182 | " | 1.8 K " |
| R95 | " -391 | " | 390 " |
| R96 | " -152 | " | 1.5 K " |
| R97 | " -154 | " | 150 K " |
| R98 | QVP4A0B-223 | VR | 22 K |
| R99 | QRD187J-821 | CR | 820 1/8 W, J |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R100 | QRD187J-122 | CR | 1.2 K 1/8 W, J |
| R110 | " -104 | " | 100 K " |
| R201 | QRD187J-391 | CR | 390 1/8 W, J |
| R202 | " -102 | " | 1 K " |
| R203 | " -391 | " | 390 " |
| R204 | " -102 | " | 1 K " |
| R205 | " -472 | " | 4.7 K " |
| R206 | " -222 | " | 2.2 K " |
| R207 | " -221 | " | 220 " |
| R208 | " -222 | " | 2.2 K " |
| R209 | " -472 | " | 4.7 K " |
| R210 | " -103 | " | 10 K " |
| R211 | " -104 | " | 100 K " |
| R212 | " -105 | " | 1 M " |
| R213 | " -473 | " | 47 K " |
| R214 | " -154 | " | 150 K " |
| R215 | QVP4A0B-222 | VR | 2.2 K |
| R216 | " -103 | " | 10 K |
| R217 | QRD187J-103 | CR | 10 K 1/8 W, J |
| R218 | " -103 | " | 10 K " |
| R219 | " -182 | " | 1.8 K " |
| R220 | " -182 | " | 1.8 K " |
| R221 | " -221 | " | 220 " |
| R222 | " -472 | " | 4.7 K " |
| R223 | " -682 | " | 6.8 K " |
| R224 | " -102 | " | 1 K " |
| R225 | " -102 | " | 1 K " |
| R226 | " -393 | " | 39 K " |
| R227 | " -683 | " | 68 K " |
| R228 | " -221 | " | 220 " |
| R229 | " -222 | " | 2.2 K " |
| R230 | " -823 | " | 82 K " |
| R231 | " -222 | " | 2.2 K " |
| R232 | " -563 | " | 56 K " |
| R233 | " -561 | " | 560 " |
| R234 | " -103 | " | 10 K " |
| R235 | " -393 | " | 39 K " |
| R236 | " -151 | " | 150 " |
| R237 | " -102 | " | 1 K " |
| R238 | QVP4A0B-471 | VR | 470 |
| R239 | – | – | |
| R240 | QRD187J-472 | CR | 4.7 K 1/8 W, J |
| R241 | " -391 | " | 390 " |
| R242 | " -391 | " | 390 " |
| R243 | " -391 | " | 390 " |
| R244 | " -391 | " | 390 " |
| R245 | " -391 | " | 390 " |
| R246 | " -332 | " | 3.3 K " |
| R247 | " -102 | " | 1 K " |
| R248 | " -152 | " | 1.5 K " |
| R249 | QVP4A0B-222 | VR | 2.2 K |
| R250 | QRD187J-471 | CR | 470 1/8 W, J |
| R251 | " -222 | " | 2.2 K " |
| R252 | " -221 | " | 220 " |
| R253 | " -153 | " | 15 K " |
| R254 | " -393 | " | 39 K " |
| R255 | " -103 | " | 10 K " |
| R256 | " -394 | " | 390 K " |
| R257 | " -103 | " | 10 K " |
| R258 | " -103 | " | 10 K " |
| R259 | " -182 | " | 1.8 K " |
| R260 | " -821 | " | 820 K " |
| R261 | " -104 | " | 100 K " |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R262 | QRD187J-223 | CR | 22 K 1/8 W, J |
| R263 | " -182 | " | 1.8 K " |
| R264 | " -333 | " | 33 K " |
| R265 | – | – | |
| R266 | QRD187J-273 | CR | 27 K 1/8 W, J |
| R267 | " -562 | " | 5.6 K " |
| R268 | QRG126J-151 | OMF R | 150 1/2 W, J |
| R269 | QRD187J-152 | CR | 1.5 K 1/8 W, J |
| R270 | " -391 | " | 390 " |
| R271 | " -102 | " | 1 K " |
| R272 | " -122 | " | 1.2 K " |
| R273 | " -823 | " | 82 K " |
| R274 | " -563 | " | 56 K " |
| R275 | " -561 | " | 560 " |
| R276 | " -123 | " | 12 K " |
| R277 | " -472 | " | 4.7 K " |
| R278 | " -102 | " (EG Type only) | 1 K " |
| R279 | " -564 | " | 560 K " |
| R280 | " -103 | " | 10 K " |
| R281 | " -103 | " | 10 K " |
| R282 | " -222 | " | 2.2 K " |
| R283 | QVP4A0B-472 | VR | 4.7 K |
| R284 | QRD187J-392 | CR | 3.9 K 1/8 W, J |
| R285 | " -103 | " | 10 K " |
| R286 | " -182 | " | 1.8 K " |
| R287 | " -561 | " | 560 " |
| R288 | " -183 | " – | 18 K " |
| R289 | " -102 | " | 1 K " |
| R290 | " -221 | " (EG Type only) | 220 " |
| R291 | " -104 | " | 100 K " |
| R292 | " -563 | " | 56 K " |
| R293 | " -101 | " – | 100 " |
| R294 | " -222 | " | 22 K " |
| R295 | " -473 | " | 47 K " |
| R296 | " -392 | " | 3.9 K " |
| R297 | " -183 | " | 18 K " |
| R298 | " -223 | " | 22 K " |
| R299 | " -103 | " | 10 K " |
| R300 | " -183 | " | 18 K " |
| R301 | QVP4A0B-103 | VR | 10 K |
| R302 | QRD187J-223 | CR | 22 K 1/8 W, J |
| R303 | " -562 | " | 5.6 K " |
| R304 | " -561 | " | 560 " |
| R305 | " -272 | " | 2.7 K " |
| R306 | " -393 | " | 39 K " |
| R307 | " -472 | " | 4.7 K " |
| R308 | " -153 | " | 15 K " |
| R309 | " -152 | " | 1.5 K " |
| R310 | " -152 | " | 1.5 K " |
| R311 | QVP4A0B-102 | VR | 1 K |
| R312 | QRD187J-822 | CR | 8.2 K 1/8 W, J |
| R313 | " -183 | " | 18 K " |
| R314 | " -271 | " | 270 " |
| R315 | " -271 | " | 270 " |
| R316 | " -222 | " | 2.2 K " |
| R317 | " -332 | " | 3.3 K " |
| R318 | " -272 | " | 2.7 K " |
| R319 | " -102 | " | 1 K " |
| R320 | " -103 | " | 10 K " |
| R321 | " -103 | " | 10 K " |
| R322 | " -221 | " | 220 " |
| R323 | " -102 | " | 1 K " |
| R324 | " -333 | " | 33 K " |
| R325 | " -103 | " | 10 K " |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R326 | QRD187J-102 | CR | 1 K 1/8 W, J |
| R327 | " -333 | " | 33 K " |
| R328 | " -103 | " | 10 K " |
| R329 | QRG126J-101 | OMF R | 100 1/2 W, J |
| R330 | QRD187J-102 | CR | 1 K 1/8 W, J |
| R331 | " -272 | " | 2.7 K " |
| R332 | " -272 | " (EK Type only) | 2.7 K " |
| R333 | " -221 | " | 220 " |
| R334 | " -331 | " | 330 " |
| R335 | QVP4A0B-222 | VR | 2.2 K |
| R336 | QRD187J-331 | CR | 330 1/8 W, J |
| R337 | " -222 | " | 2.2 K " |
| R338 | " -394 | " | 390 K " |
| R339 | " -182 | " | 3.3 K " |
| C 1 | QEW61CA-476 | E Cap | 47 16 V |
| C 2 | QEW60JA-107 | " | 100 6.3 V |
| C 3 | " -227 | " | 220 " |
| C 4 | QCS31HJ-560 | C Cap | 56 P 50 V |
| C 5 | QEW61CA-476 | E Cap | 47 16 V |
| C 6 | QCF31HP-223 | C Cap | 0.022 50 V |
| C 7 | QEW60JA-476 | E Cap | 47 6.3 V |
| C 8 | QEW61AA-476 | " | 47 10 V |
| C 9 | QEW60JA-476 | " | 47 6.3 V |
| C10 | QCF31HP-223 | C Cap | 0.022 50 V |
| C11 | QEW60JA-227 | E Cap | 220 6.3 V |
| C12 | " -476 | " | 47 " |
| C13 | " -476 | " | 47 " |
| C14 | QEW61HA-105 | " | 1 50 V |
| C15 | QEN41CM-106 | NP Cap | 10 16 V |
| C16 | QCS31HJ-270 | C Cap | 27 P 50 V |
| C17 | QEW61CA-106 | E Cap | 10 16 V |
| C18 | QCS31HJ-391 | C Cap | 390 P 50 V |
| C19 | QEW61HA-105 | E Cap | 1 " |
| C20 | QEW61CA-476 | " | 47 16 V |
| C21 | QEW60JA-336 | " | 33 6.3 V |
| C22 | " -476 | " | 47 " |
| C23 | QCS31HJ-270 | C Cap | 27 P 50 V |
| C24 | QEW60JA-336 | E Cap | 33 6.3 V |
| C25 | QCS31HJ-471 | C Cap | 470 P 50 V |
| C26 | QEW61CA-476 | E Cap | 47 16 V |
| C27 | QCS31HJ-680 | C Cap | 68 P 50 V |
| C28 | QEW60JA-476 | E Cap | 47 6.3 V |
| C29 | " -476 | " | 47 " |
| C30 | – | – | – – |
| C31 | – | – | – – |
| C32 | QEW61CA-476 | E. Cap | 47 16 V |
| C33 | QCF31HP-223 | C Cap | 0.022 50 V |
| C34 | – | – | – – |
| C35 | QCS31HJ-820 | C Cap | 82 P 50 V |
| C36 | QFM31HK-103 | MY Cap | 0.01 " |
| C37 | QCS31HJ-121 | C Cap | 120 P " |
| C38 | QFM31HK-103 | MY Cap | 0.01 " |
| C39 | QCS31HJ-121 | C Cap | 120 P " |
| C40 | QFM31HK-103 | MY Cap | |
| C41 | " -102 | " | 0.001 50 V |
| C42 | " -103 | " | 0.01 " |
| C43 | " -103 | " | 0.01 " |
| C44 | QCS31HJ-101 | C Cap | 100 P " |
| C45 | QFM31HK-103 | MY Cap | 0.01 " |
| C46 | " -103 | " | 0.01 " |
| C47 | QEW61HA-105 | E Cap | 1 " |
| C48 | QFM31HK-103 | MY Cap | 0.01 " |

| Symbol No. | Part No. | Part Name | Description | |
|---|---|---|---|---|
| C49 | QCF31HP-223 | C Cap | 0.022 | 50 V |
| C50 | QFM31HK-103 | MY Cap | 0.01 | " |
| C51 | QCS31HJ-220 | C Cap | 22 P | " |
| C52 | QEW61CA-336 | E Cap | 33 | 16 V |
| C53 | QCF31HP-223 | C Cap | 0.022 | 50 V |
| C54 | QFM31HK-103 | MY Cap | 0.01 | " |
| C55 | " -103 | " | 0.01 | " |
| C56 | QEW61AA-477 | E Cap | 470 | 10 V |
| C57 | QCF31HP-223 | C Cap | 0.022 | 50 V |
| C58 | QEW61CA-107 | E Cap | 100 | 16 V |
| C59 | QEW61EA-475 | " | 4.7 | 25 V |
| C60 | QCS31HJ-471 | C Cap | 470 P | 50 V |
| C61 | QEN41CM-106 | NP Cap | 10 | 16 V |
| C62 | QCS31HJ-390 | C Cap | 39 P | 50 V |
| C63 | QEW61AA-476 | E Cap | 47 | 10 V |
| C64 | QEW60JA-476 | " | 47 | 6.3 V |
| C65 | QEW61EA-475 | " | 4.7 | 25 V |
| C66 | QEW61CA-106 | " | 10 | 16 V |
| C67 | QEW61AA-476 | " | 47 | 10 V |
| C68 | QCS31HJ-150 | C Cap | 15 P | 50 V |
| C69 | " -391 | " | 390 P | " |
| C70 | " -331 | " | 330 | " |
| C71 | QEW61CA-106 | E Cap | 10 | 16 V |
| C72 | QCS31HJ-100 | C Cap | 10 P | 50 V |
| C73 | QEW60JA-476 | E Cap | 47 | 6.3 V |
| C74 | QEW61CA-476 | " | 47 | 16 V |
| C75 | QEW60JA-107 | " | 100 | 6.3 V |
| C76 | QEW61AA-476 | " | 47 | 10 V |
| C77 | QEW61CA-336 | " | 33 | 16 V |
| C78 | QFM31HK-103 | MY Cap | 0.01 | 50 V |
| C79 | " -103 | " | 0.01 | " |
| C80 | QEW61CA-336 | E Cap | 33 | 16 V |
| C81 | QCF31HP-223 | C Cap | 0.022 | 50 V |
| C82 | QFM31HK-103 | MY Cap | 0.01 | " |
| C83 | QCF31HP-223 | C Cap | 0.022 | " |
| C84 | " -223 | " | 0.022 | " |
| C85 | QFM31HK-103 | MY Cap | 0.01 | " |
| C86 | QEW61CA-336 | E Cap | 33 | 16 V |
| C87 | QFM31HK-103 | MY Cap | 0.01 | 50 V |
| C88 | QCF31HP-223 | C Cap | 0.022 | " |
| C89 | QEW61HA-105 | E Cap | 1 | " |
| C90 | QFM31HK-103 | MY Cap | 0.01 | " |
| C91 | QCF31HP-223 | C Cap | 0.022 | " |
| C92 | QEW61CA-336 | E Cap | 33 | 16 V |
| C93 | QFM31HK-103 | MY Cap | 0.01 | 50 V |
| C94 | " -103 | " | 0.01 | " |
| C95 | " -103 | " | 0.01 | " |
| C96 | QCF31HP-223 | C Cap | 0.022 | " |
| C97 | " -223 | " | 0.022 | " |
| C98 | " -223 | " | 0.022 | " |
| C99 | QEW61CA-476 | E Cap | 47 | 16 V |
| C100 | QCS31HJ-121 | C Cap | 120 P | 50 V |
| C101 | " -330 | " | 33 P | " |
| C102 | QCF31HP-223 | " | 0.022 | " |
| C103 | QCS31HJ-301 | " | 300 P | " |
| C110 | QEW61CA-106 | " | | |
| C201 | QFM31HK-103 | MY Cap | 0.01 | 50 V |
| C202 | QEW61CA-106 | E Cap | 10 | 16 V |
| C203 | QFM31HK-333 | MY Cap | 0.033 | 50 V |
| C204 | " -103 | " | 0.01 | " |
| C205 | QCS31HJ-680 | C Cap | 68 P | " |
| C206 | QFM31HK-123 | MY Cap | 0.012 | " |
| C207 | QCS31HJ-331 | C Cap | 330 P | " |

| Symbol No. | Part No. | Part Name | Description | |
|---|---|---|---|---|
| C208 | QFM31HK-223 | MY Cap | 0.022 | 50 V |
| C209 | " -103 | " | 0.01 | " |
| C210 | QCS31HJ-151 | C Cap | 150 P | " |
| C211 | QEW61CA-476 | E Cap | 47 | 16 V |
| C212 | QFM31HK-333 | MY Cap | 0.033 | 50 V |
| C213 | QCF31HP-223 | C Cap | 0.022 | " |
| C214 | QFM31HK-223 | MY Cap | 0.022 | " |
| C215 | " -333 | " | 0.033 | " |
| C216 | " -103 | " | 0.01 | " |
| C217 | " -104 | " | 0.1 | " |
| C218 | QCF31HP-223 | C Cap | 0.022 | " |
| C219 | QFM31HK-104 | MY Cap | 0.1 | " |
| C220 | " -103 | " | 0.01 | " |
| C221 | QCS31HJ-101 | C Cap | 100 P | " |
| C222 | QEW61CA-106 | E Cap | 10 | 16 V |
| C223 | QCF31HP-223 | C Cap | 0.022 | 50 V |
| C224 | QEW61CA-106 | E Cap | 10 | 16 V |
| C225 | QFM31HK-333 | MY Cap | 0.033 | 50 V |
| C226 | QCF31HP-223 | C Cap | 0.022 | " |
| C227 | QFM31HK-103 | MY Cap | 0.01 | " |
| C228 | QEW61CA-106 | E Cap | 10 | 16 V |
| C229 | QCF31HP-223 | C Cap | 0.022 | 50 V |
| C230 | QFM31HK-103 | MY Cap | 0.01 | " |
| C231 | QCS31HJ-560 | C Cap | 56 P | " |
| C232 | QFM31HK-103 | MY Cap | 0.01 | " |
| C233 | QCS31HJ-331 | C Cap | 330 P | " |
| C234 | QEW61CA-106 | E Cap | 10 | 16 V |
| C235 | QFM31HK-102 | MY Cap | 0.001 | 50 V |
| C236 | " -103 | " | 0.01 | " |
| C237 | " -103 | " | 0.01 | " |
| C238 | QCF31HP-223 | C Cap | 0.022 | " |
| C239 | QFM31HK-102 | MY Cap | 0.001 | " |
| C240 | QEW61CA-336 | E Cap | 33 | 16 V |
| C241 | QFM31HK-103 | MY Cap | 0.01 | 50 V |
| C242 | " -102 | " | 0.001 | " |
| C243 | QEE41CM-336 | T Cap | 33 | 16 V |
| C244 | QFM31HK-102 | MY Cap | 0.001 | 50 V |
| C245 | QCF31HP-223 | C Cap | 0.022 | " |
| C246 | QFM31HK-222 | MY Cap | 0.0022 | " |
| C247 | QCT05UJ-330 | C Cap | 33 P | |
| C248 | – | – | | |
| C249 | QCT05UJ-390 | C Cap | 39 P | 50 V |
| C250 | QFM31HK-222 | MY Cap | 0.0022 | " |
| C251 | QCT05UJ-150 | C Cap | 15 P | |
| C252 | QCS31HJ-390 | " | 39 P | 50 V |
| C253 | QFM31HK-104 | MY Cap | 0.1 | " |
| C254 | QEW61CA-336 | E Cap | 33 | 16 V |
| C255 | – | – | | |
| C256 | QEE41EM-335 | T Cap | 3.3 | 25 V |
| C257 | QFM31HK-102 | MY Cap | 0.001 | 50 V |
| C258 | QEE41AM-476 | T Cap | 47 | 10 V |
| C259 | QEW61EA-335 | E Cap | 3.3 | 25 V |
| C260 | QFM31HK-102 | MY Cap | 0.001 | 50 V |
| C261 | QEW61CA-476 | E Cap | 47 | 16 V |
| C262 | QFM31HK-222 | MY Cap | 0.0022 | 50 V |
| C263 | QCS31HJ-471 | C Cap | 470 P | " |
| C264 | QCF31HP-223 | " | 0.022 | " |
| C265 | QCS31HJ-330 | " | 33 P | " |
| C266 | " -331 | " | 330 P | " |
| C267 | " -560 | " | 56 P | " |
| C268 | QFM31HK-103 | MY Cap | 0.01 | " |
| C269 | QCS31HJ-331 | C Cap | 330 | " |
| C270 | QFM31HK-102 | MY Cap | 0.001 | " |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| C271 | QEE41EM-105 | T Cap | 1 25 V |
| C272 | QFM31HK-102 | MY Cap (EG Type only) | 0.001 50 V |
| C273 | QEW61CA-106 | E Cap | 10 16 V |
| C274 | QEW61HA-105 | " | 1 50 V |
| C275 | QFM31HK-102 | MY Cap (EG Type only) | 0.001 " |
| C276 | " -223 | " | 0.022 " |
| C277 | " -103 | " | 0.01 " |
| C278 | QFM71HJ-563 | " | 0.056 " |
| C279 | QEW60JA-336 | E Cap (EG Type | 33 6.3 V |
| C280 | QCF31HP-223 | C Cap only) | 0.022 50 V |
| C281 | QEW61CA-476 | E Cap | 47 16 V |
| C282 | " -476 | " | 47 " |
| C283 | QFM31HK-103 | MY Cap | 0.01 50 V |
| C284 | QCS31HJ-101 | C Cap | 100 P " |
| C285 | QFM31HK-103 | MY Cap | 0.01 " |
| C286 | QCS31HJ-101 | C Cap | 100 P " |
| C287 | QEW61CA-336 | E Cap | 33 16 V |
| C288 | " -336 | " | 33 " |
| C289 | QEW61EA-475 | " | 4.7 25 V |
| C290 | QFM31HK-152 | MY Cap | 0.0015 50 V |
| C291 | " -682 | " | 0.0068 " |
| C292 | QCF31HP-223 | C Cap | 0.022 " |
| C293 | QCT25CH-101 | " | 100 P " |
| C294 | QCT05UJ-100 | " | 10 P |
| C295 | QAT3001-008 | Trimmer Cap | |
| C296 | QCS31HJ-181 | C Cap | 180 P 50 V |
| C297 | QCT05UJ-820 | " | 82 P |
| C298 | QCF31HP-223 | " | 0.022 50 V |
| C299 | QEW61CA-476 | E Cap | 47 16 V |
| C300 | QFM31HK-103 | MY Cap | 0.01 50 V |
| C301 | " -102 | " | 0.001 " |
| C302 | " -102 | " | 0.001 " |
| C303 | QCS31HJ-470 | C Cap | 47 P " |
| C304 | " -330 | " | 33 P " |
| C305 | QFM31HK-102 | MY Cap | 0.001 " |
| C306 | QCF31HP-223 | C Cap | 0.022 " |
| C307 | QFM31HK-102 | MY Cap | 0.001 " |
| C308 | QCS31HJ-390 | C Cap | 39 P " |
| C309 | " -390 | " | 39 P " |
| C310 | QEW61CA-107 | E Cap | 100 16 V |
| C311 | QCS31HJ-121 | C Cap | 120 P 50 V |
| C312 | " -391 | " | 390 P " |
| C313 | " -331 | " | 330 P " |
| C314 | QFM31HK-122 | MY Cap | 0.0012 " |
| C315 | " -103 | " | 0.01 " |
| C316 | " -103 | " | 0.01 " |
| C317 | " -563 | " | 0.056 " |
| C318 | " -103 | " | 0.01 " |
| C319 | " -103 | " | 0.01 " |
| C320 | QCF31HP-223 | C Cap | 0.22 " |
| L 1 | A040725-68 | Peaking Coil | 68 μH |
| L 2 | PU46021-101 | Choke Coil | 100 μH |
| L 3 | A040725-100 | Peaking Coil | 100 μH |
| L 4 | " -56 | " | 56 μH |
| L 5 | " -18 | " | 18 μH |
| L 6 | " -100 | " | 100 μH |
| L 7 | " -33 | " | 33 μH |
| L 8 | " -47 | " | 47 μH |
| L 9 | " -56 | " | 56 μH |
| L10 | " -220 | " | 220 μH |
| L11 | " -8.2 | " | 8.2 μH |
| L12 | " -100 | " | 100 μH |
| L13 | " -18 | " | 18 μH |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| L14 | A040725-5.6 | Peaking Coil | 5.6 μH |
| L15 | " -1 | " | 1 μH |
| L16 | PU46021-101 | Choke Coil | 100 μH |
| L17 | A04725-100 | Peaking Coil | 100 μH |
| L18 | " -100 | " | 100 μH |
| L19 | " -1200 | " | 1.2 mH |
| L20 | " -100 | " | 100 μH |
| L21 | " -47 | " | 47 μH |
| L22 | " -100 | " | 100 μH |
| L201 | PU47051-822 | Coil | 8.2 mH |
| L202 | A04725-100 | Peaking Coil | 100 μH |
| L203 | PU46003-3R9 | " | 3.9 μH |
| L204 | A04725-100 | " | 100 μH |
| L205 | PU46398-2 | Coil | 6.8 μH |
| L206 | PU46003-6R8 | Peaking Coil | 6.8 μH |
| L207 | PU46021-101 | Choke Coil | 100 μH |
| L208 | A04725-39 | Peaking Coil | 39 μH |
| L209 | PU46003-3R9 | " | 3.9 μH |
| L210 | " -3R9 | " | 3.9 μH |
| L211 | PU47051-822 | Coil (EG Type only) | 8.2 mH |
| L212 | PU46021-101 | Choke Coil | 100 μH |
| L213 | PU47051-822 | Coil | 8.2 mH |
| L214 | " -822 | " | 8.2 mH |
| RLC 1 | PU46020-4 | RLC Block | |
| LPF 1 | PU30192-9D | Low Pass Filter | |
| LPF 2 | PU31932-2 | " | |
| LPF201 | PU30192-1D | " | |
| BPF201 | PU30190-6S | Band Pass Filter | |
| BPF202 | " -6S | " | |
| BPF203 | PU46041 | " | |
| HPF 1 | PU30487-4D | High Pass Filter | |
| DL 1 | PU43627C | 1-H Delay Line | |
| DL201 | PU47198 | Delay Equalizer | |
| DL202 | PU46321-3 | 2-H Delay Line | |
| DF 1 | PU30773 | Demod. Filter | |
| EQ 1 | PU31933-3 | Equalizer | EG Type only |
| EQ 2 | PU31933 | " | |
| CF201 | PU46521 | Ceramic Filter | EG Type only |
| CT201 | PU46042 | Ceramic Trap | |
| X'tal 201 | PU46040 | Crystal | (4.435571 MHz) |
| X'tal 202 | PU31449-2 | " | (4.433619 MHz) |
| | PU43351-3 | Cap. Housing | (41–43)(81–83) |
| | " -3Y | " | (71–73) |
| | " -4 | " | (31–34)(51–54) |
| | " -5 | " | (21–25) |
| | " -6 | " | (11–16) |
| | PU43092 | Collar | |
| | A74138-1 | Test Pin | |
| | PU46006 | Shield Case | |
| | PU47291 | Shield Plate | |
| | PU47332 | Shield Case | |
| | PU31302 | PWB Bracket | |
| | DPSP3006ZS | Screw | |
| | NNS3000NS | Nut | |
| | PU42697H | RF Mod. Unit | See Item 11-4. |

## 11-4 FM MODULATOR UNIT . . . . . PU42697H

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU42697 | Printed board | |
| X 1 | 2N2369 | Transistor | |
| X 2 | " | " | |
| R 1 | QVP4A0B-102 | VR | 1 K |
| R 2 | QRD143K-182 | CR | 1.8 K 1/4 W, K |
| R 3 | " -182 | " | 1.8 K " |
| R 4 | " -151 | " | 150 " |
| R 5 | " -331 | " | 330 " |
| R 6 | " -682 | " | 6.8 K " |
| R 7 | " -682 | " | 6.8 K " |
| R 8 | " -331 | " | 330 " |
| R 9 | " -181 | " | 180 " |
| C 1 | PU30767-220 | Feed Through Cap | 22 P |
| C 2 | QCT05CH-470 | FC Cap | 47 P |
| C 3 | " -390 | " | 39 P |
| C 4 | QAT3001-015 | Trimmer Cap | |
| C 5 | PU30767-102 | Feed Through Cap | 1000 P |
| C 6 | QEW41HA-105 | E Cap | 1 50 V |
| C 7 | PU30767-220 | Feed Through Cap | 22 P |
| T 1 | PU30769 | FM M. Trans. | |
| | PU42674 | Shield Case | |
| | PU42675-2 | " | |
| | " -3 | " | |

## 11-5 PRE/RECORD (PRE/REC) PRINTED CIRCUIT BOARD ASS'Y . . . . . HR4100EG: PU46016H HR4100EK: PU46016I

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU20749 | Printed board | |
| IC 1 | 6A753 | Integrated Circuit | |
| IC 2 | " | " | |
| IC 3 | 18V103 | " | |
| X 1 | 2SC829C | Transistor | |
| X 2 | " | " | |
| X 3 | 2SA564Q | " | |
| X 4 | 2SA719R | " | |
| X 5 | 2SC1317R | " | |
| X 6 | " | " | |
| X 7 | 2SA719R | " | |
| X 8 | 2SC1317R | " | |
| X 9 | " | " | |
| X10 | 2SC828Q | " | |
| X11 | " | " | |
| X12 | 2SC829C | " | |
| X13 | " | " | |
| X14 | 2SC1317R | " | |
| X15 | 2SA564Q | " | |
| D 1 | OA91 | Diode | |
| D 2 | MA150LF | " | |
| D 3 | " | " | |
| R 1 | QVP4A0B-102 | VR | 1 K |
| R 2 | " -102 | " | 1 K |
| R 3 | QRD181J-103 | CR | 10 K 1/8 W, J |
| R 4 | " -222 | " | 2.2 K |
| R 5 | " -222 | " | 2.2 K " |
| R 6 | " -682 | " | 6.8 K " |
| R 7 | " -224 | " | 220 K " |
| R 8 | " -273 | " | 27 K " |
| R 9 | " -822 | " | 8.2 K " |
| R10 | " -561 | " | 560 " |
| R11 | " -220 | " | 22 " |
| R12 | " -102 | " | 1 K " |
| R13 | " -102 | " | 1 K " |
| R14 | " -562 | " | 5.6 K " |
| R15 | " -562 | " | 5.6 K " |
| R16 | " -102 | " | 1 K " |
| R17 | QRX126J-100 | MF R | 10 1/2 W, J |
| R18 | QRD181J-100 | CR | 10 1/8 W, J |
| R19 | " -682 | " | 6.8 K " |
| R20 | QRX126J-4R7 | MF R | 4.7 1/2 W, J |
| R21 | " -4R7 | " | 4.7 " |
| R22 | QRD181J-562 | CR | 5.6 K 1/8 W, J |
| R23 | " -180 | " | 18 " |
| R24 | QVP4A0B-101 | VR | 100 |
| R25 | QRD181J-330 | CR | 33 1/8 W, J |
| R26 | " -272 | " | 2.7 K " |
| R27 | " -272 | " | 2.7 K " |
| R28 | " -3R9 | " | 3.9 " |
| R29 | " -3R9 | " | 3.9 " |
| R30 | " -272 | " | 2.7 K " |
| R31 | " -272 | " | 2.7 K " |
| R32 | " -391 | " | 390 " |
| R33 | QVP4A0B-103 | VR | 10 K |
| R34 | " -103 | " | 10 K |
| R35 | QRD181J-391 | CR | 390 1/8 W, J |
| R36 | " -101 | " | 100 |
| R37 | " -101 | " | 100 |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R38 | QRD181J-273 | CR | 27 K 1/8 W, J |
| R39 | " -472 | " | 4.7 K " |
| R40 | " -472 | " | 4.7 K " |
| R41 | " -273 | " | 27 K " |
| R42 | " -102 | " | 1 K " |
| R43 | " -151 | " | 150 " |
| R44 | " -151 | " | 150 " |
| R45 | " -102 | " | 1 K " |
| R46 | " -472 | " | 4.7 K " |
| R47 | " -472 | " | 4.7 K " |
| R48 | QVP4A0B-222 | VR | 2.2 K |
| R49 | " -222 | " | 2.2 K |
| R50 | QRD181J-221 | CR | 220 1/8 W, J |
| R51 | " -182 | " | 1.8 K " |
| R52 | QVP4A0B-222 | VR | 2.2 K |
| R53 | QRD181J-221 | CR | 220 1/8 W, J |
| R54 | " -272 | " | 2.7 K " |
| R55 | QVP4A0B-222 | VR | 2.2 K |
| R56 | QRD181J-221 | CR | 220 1/8 W, J |
| R57 | " -184 | " | 180 K " |
| R58 | " -103 | " | 10 K " |
| C 1 | QCF31HP-223 | C Cap | 0.022 50 V |
| C 2 | QEW41CA-476 | E Cap | 47 16 V |
| C 3 | QFM31HK-223 | MY Cap | 0.022 50 V |
| C 4 | QEW60JA-227 | E Cap | 220 6.3 V |
| C 5 | QFM31HK-223 | MY Cap | 0.022 50 V |
| C 6 | " -333 | " | 0.033 " |
| C 7 | " -333 | " | 0.033 " |
| C 8 | QCS31HJ-100 | C Cap | 10 P " |
| C 9 | QFM31HK-392 | MY Cap | 0.0039 " |
| C10 | QEE41CM-106 | T Cap | 10 16 V |
| C11 | " -106 | " | 10 " |
| C12 | QCF31HP-223 | C Cap | 0.022 50 V |
| C13 | " -223 | " | 0.022 " |
| C14 | " -223 | " | 0.022 " |
| C15 | " -223 | " | 0.022 " |
| C16 | QCS31HJ-100 | " | 10 P " |
| C17 | " -100 | " | 10 P " |
| C18 | QAT3001-009 | Trimmer Cap | |
| C19 | " -009 | " | |
| C20 | QEW61CA-336 | E Cap | 33 16 V |
| C21 | QCF31HP-223 | C Cap | 0.022 50 V |
| C22 | " -223 | " | 0.022 " |
| C23 | " -223 | " | 0.022 " |
| C24 | QEW61CA-336 | E Cap | 33 16 V |
| C25 | QCF31HP-223 | C Cap | 0.022 50 V |
| C26 | QCS11HJ-223 | " (EG Type) | 0.022 " |
| | " -151 | " (EK Type) | 150 P " |
| C27 | QCF31HP-223 | " | 0.022 " |
| C28 | " -223 | " | 0.022 " |
| C29 | QCS31HJ-151 | " | 150 P " |
| C30 | QCF31HP-223 | " (EG Type) | 0.022 " |
| | QCS31HJ-151 | " (EK Type) | 150 P " |
| C31 | " -151 | " | 150 P " |
| C32 | QCF31HP-223 | " | 0.022 " |
| C33 | " -223 | " | 0.022 " |
| C34 | QEW61CA-336 | E Cap | 33 16 V |
| C35 | QCS31HJ-221 | C Cap | 220 P 50 V |
| C36 | QEW61CA-336 | E Cap | 33 16 V |
| C37 | QFM31HK-223 | MY Cap | 0.022 50 V |
| C38 | " -223 | " | 0.022 " |
| C39 | " -562 | " | 0.0056 " |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| C40 | QFM31HK-102 | MY Cap | 0.001 50 V |
| C41 | " -223 | " | 0.022 " |
| C42 | " -103 | " | 0.01 " |
| C43 | QCS31HJ-221 | C Cap | 220 P " |
| C44 | QFM31HK-102 | MY Cap | 0.001 " |
| C45 | QCS31HJ-330 | C Cap | 33 P " |
| C46 | QEW61CA-336 | E Cap | 33 20 V |
| C47 | QFM31HK-223 | MY Cap | 0.022 50 V |
| C48 | QCF31HP-223 | C Cap | 0.022 " |
| C49 | QFM31HK-102 | MY Cap | 0.001 " |
| C50 | QCS31HJ-180 | C Cap | 18 P " |
| C51 | QFM41HK-123 | MY Cap (EG Type only) | 0.012 " |
| L 1 | A04725-56 | Peaking Coil | |
| L 2 | " -100 | " | |
| L 3 | " -47 | " | |
| L 4 | " -47 | " | |
| L 5 | " -100 | " | |
| L 6 | " -820 | " | |
| L 7 | " -39 | " | |
| L 8 | " -82 | " | |
| L 9 | A04096-8200 | " | HR-4100EG only |
| LPF-1 | PU30192-1D | L.P.F. | |
| | PU43092 | Collar | for R17, 20, 21 |
| | PU43351-5 | Cap. Housing | Conn. 11–15 |
| | " -4 | " | Conn. 21–24 |
| | " -6 | " | Conn. 31–36 |
| | " -3 | " | Conn. 61–63 |

## 11-6 AUDIO/SERVO (A/S) PRINTED CIRCUIT BOARD ASS'Y . . . . . PU46178B

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU20649 | Printed board | |
| IC 1 | AN301 | Integrated Circuit | |
| IC 2 | AN608 | " | |
| IC 3 | AN318 | " | |
| IC 4 | HA17555PS | " | |
| IC 5 | UPC1458C | " | |
| IC 6 | UA741TC | " | |
| IC 7 | AN262 | " | |
| X 1 | 2SA844C | Transistor | |
| X 2 | 2SC460C | " | |
| X 3 | 2SA844C | " | |
| X 4 | 2SC460C | " | |
| X 5 | " | " | |
| X 6 | 2SK40C | F.E.T. | |
| X 7 | 2SC460C | Transistor | |
| X 8 | " | " | |
| X 9 | " | " | |
| X10 | " | " | |
| X11 | – | – | |
| X12 | 2SA844C | Transistor | |
| X13 | 2SC460C | " | |
| X14 | " | " | |
| X15 | – | – | |
| X16 | 2SC460C | Transistor | |
| X17 | " | " | |
| X18 | 2SC1162WTC | " | |
| X19 | " | " | |
| D 1 | 1S2473 | Diode | |
| D 2 | " | " | |
| D 3 | " | " | |
| D 4 | " | " | |
| D 5 | " | " | |
| D 6 | " | " | |
| D 7 | " | " | |
| D 8 | " | " | |
| D 9 | " | " | |
| D10 | " | " | |
| D11 | " | " | |
| D12 | " | " | |
| D13 | " | " | |
| D14 | " | " | |
| D15 | " | " | |
| D16 | " | " | |
| D17 | – | – | |
| D18 | RD3.9EC | Zener Diode | |
| D19 | 1S2473 | Diode | |
| D20 | " | " | |
| D21 | OA90 | " | |
| D22 | 1S2473 | " | |
| D23 | MA26W | " | |
| R 1 | QRD187J-472 | CR | 4.7 K 1/8 W, J |
| R 2 | " -103 | " | 10 K " |
| R 3 | " -103 | " | 10 K " |
| R 4 | " -103 | " | 10 K " |
| R 5 | " -474 | " | 470 K " |
| R 6 | " -154 | " | 150 K " |
| R 7 | " -103 | " | 10 K " |
| R 8 | QRG126J-101M | OMF R | 100 1/2 W, J |
| R 9 | QRD187J-102 | CR | 1 K 1/8 W, J |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R10 | QRD187J-223 | CR | 22 K 1/8 W, J |
| R11 | " -223 | " | 22 K " |
| R12 | " -154 | " | 150 K " |
| R13 | " -154 | " | 150 K " |
| R14 | QVP4A0B-224 | VR | 220 K |
| R15 | QRD187J-682 | CR | 6.8 K 1/8 W, J |
| R16 | " -333 | " | 33 K " |
| R17 | " -103 | " | 10 K " |
| R18 | " -223 | " | 22 K " |
| R19 | " -104 | " | 100 K " |
| R20 | " -472 | " | 4.7 K " |
| R21 | QVP4A0B-103 | VR | 10 K |
| R22 | QRD187J-333 | CR | 33 K 1/8 W, J |
| R23 | " -123 | " | 12 K " |
| R24 | QVP4A0B-473 | VR | 47 K |
| R25 | QRD187J-123 | CR | 12 K 1/8 W, J |
| R26 | QVP4A0B-473 | VR | 47 K |
| R27 | QRD187J-272 | CR | 2.7 K 1/8 W, J |
| R28 | QVP4A0B-473 | VR | 47 K |
| R29 | QRD187J-563 | CR | 56 K 1/8 W, J |
| R30 | QVZ3501-223 | VR | 22 K |
| R31 | QRD187J-273 | CR | 27 K 1/8 W, J |
| R32 | QRD181J-153 | " | 15 K " |
| R33 | QRD187J-103 | " | 10 K " |
| R34 | " -563 | " | 56 K " |
| R35 | " -103 | " | 10 K " |
| R36 | " -104 | " | 100 K " |
| R37 | " -474 | " | 470 K " |
| R38 | " -393 | " | 39 K " |
| R39 | " -224 | " | 220 K " |
| R40 | " -393 | " | 39 K " |
| R41 | " -103 | " | 10 K " |
| R42 | " -102 | " | 1 K " |
| R43 | " -824 | " | 820 K " |
| R44 | " -472 | " | 4.7 K " |
| R45 | " -473 | " | 47 K " |
| R46 | " -103 | " | 10 K " |
| R47 | " -224 | " | 220 K " |
| R48 | " -224 | " | 220 K " |
| R49 | " -104 | " | 100 K " |
| R50 | " -102 | " | 1 K " |
| R51 | " -823 | " | 82 K " |
| R52 | " -105 | " | 1 M " |
| R53 | " -105 | " | 1 M " |
| R54 | " -472 | " | 4.7 K " |
| R55 | " -222 | " | 2.2 K " |
| R56 | " -223 | " | 22 K " |
| R57 | " -153 | " | 15 K " |
| R58 | " -273 | " | 27 K " |
| R59 | " -103 | " | 10 K " |
| R60 | " -104 | " | 100 K " |
| R61 | " -272 | " | 2.7 K " |
| R62 | QVZ3501-102 | VR | 1 K |
| R63 | QRD187J-152 | CR | 1.5 K 1/8 W, J |
| R64 | " -475 | " | 4.7 M " |
| R65 | " -105 | " | 1 M " |
| R66 | " -273 | " | 27 K " |
| R67 | " -562 | " | 5.6 K " |
| R68 | " -103 | " | 10 K " |
| R69 | " -103 | " | 10 K " |
| R70 | " -684 | " | 680 K " |
| R71 | " -152 | " | 1.5 K " |
| R72 | " -272 | " | 2.7 K " |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| R73 | QRD187J-393 | CR | 39 K 1/8 W, J |
| R74 | " -393 | " | 39 K " |
| R75 | " -473 | " | 47 K " |
| R76 | QVP4A0B-223 | VR | 22 K |
| R77 | QRD187J-475 | CR | 4.7 M 1/8 W, J |
| R78 | – | – | |
| R79 | QRD187J-104 | CR | 100 K 1/8 W, J |
| R80 | – | – | |
| R81 | QRD187J-334 | CR | 330 K 1/8 W, J |
| R82 | " -103 | " | 10 K " |
| R83 | " -273 | " | 27 K " |
| R84 | " -563 | " | 56 K " |
| R85 | " -103 | " | 10 K " |
| R86 | " -272 | " | 2.7 K " |
| R87 | " -473 | " | 47 K " |
| R88 | " -152 | " | 1.5 K " |
| R89 | " -223 | " | 22 K " |
| R90 | QVP4A0B-223 | VR | 22 K |
| R91 | QRD141K-681 | CR | 680 1/4 W, K |
| R92 | QRD187J-103 | " | 10 K 1/8 W, J |
| R93 | " -221 | " | 220 " |
| R94 | QRD141K-681 | " | 680 1/4 W, K |
| R95 | QRD187J-222 | " | 2.2 K 1/8 W, J |
| R96 | " -103 | " | 10 K " |
| R97 | QRG126J-101M | OMF R | 100 1/2 W, J |
| R98 | QRD187J-223 | CR | 22 K 1/8 W, J |
| R99 | QVP4A0B-682 | VR | 6.8 K |
| R100 | QRD187J-152 | CR | 1.5 K 1/8 W, J |
| R101 | QVP4A0B-103 | VR | 10 K |
| R102 | QRD187J-223 | CR | 22 K 1/8 W, J |
| R103 | " -102 | " | 1 K " |
| R104 | " -223 | " | 22 K " |
| R105 | – | – | |
| R106 | QRD187J-101 | CR | 100 1/8 W, J |
| R107 | " -125 | " | 1.2 M " |
| R108 | " -564 | " | 560 K " |
| R109 | QRX126J-5R6M | MF R | 5.6 1/2 W, J |
| R110 | QRD187J-682 | CR | 6.8 K 1/8 W, J |
| R111 | " -103 | " | 10 K " |
| R112 | " -473 | " | 47 K " |
| R113 | " -223 | " | 22 K " |
| R114 | " -102 | " | 1 K " |
| R115 | " -102 | " | 1 K " |
| R116 | " -222 | " | 2.2 K " |
| R117 | QRG126J-150M | OMF R | 15 1/2 W, J |
| R118 | " -150M | " | 15 " |
| R119 | QVZ3501-473 | VR | 47 K |
| R120 | QRD187J-333 | CR | 33 K 1/8 W, J |
| R121 | QRD181J-103 | " | 10 K " |
| R122 | TD5-C220 | Thermister | |
| C 1 | QEW61CA-106M | E Cap | 10 16 V |
| C 2 | QCS31HJ-680 | C Cap | 68 P 50 V |
| C 3 | " -681 | " | 680 P " |
| C 4 | QEW61AA-476M | E Cap | 47 10 V |
| C 5 | QFM31HK-103S | MY Cap | 0.01 50 V |
| C 6 | " -103S | " | 0.01 " |
| C 7 | " -103S | " | 0.01 " |
| C 8 | QEW61HA-105M | E Cap | 1 " |
| C 9 | QFM71HJ-104M | MY Cap | 0.1 " |
| C10 | QEW61HA-105M | E Cap | 1 " |
| C11 | QCS31HJ-101 | C Cap | 100 P " |
| C12 | QEW61HA-105M | E Cap | 1 " |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| C13 | QFM41HK-124 | MY Cap | 0.12 50 V |
| C14 | " -104S | " | 0.1 " |
| C15 | QEW61CA-106M | E Cap | 10 16 V |
| C16 | QFM31HK-333S | MY Cap | 0.033 50 V |
| C17 | QEW61CA-336M | E Cap | 33 16 V |
| C18 | QCF31HP-223 | C Cap | 0.022 50 V |
| C19 | QEW61CA-106M | E Cap | 10 16 V |
| C20 | " -106M | " | 10 " |
| C21 | QFM31HK-103S | MY Cap | 0.01 50 V |
| C22 | QEW61CA-227M | E Cap | 220 16 V |
| C23 | QFM32AK-102S | MY Cap | 0.001 100 V |
| C24 | QEW61CA-476M | E Cap | 47 16 V |
| C25 | QFM32AK-102S | MY Cap | 0.001 100 V |
| C26 | QEW61CA-476M | E Cap | 47 16 V |
| C27 | QFM71HJ-473M | MY Cap | 0.047 50 V |
| C28 | QEW61CA-476M | E Cap | 47 16 V |
| C29 | QFM71HJ-822 | MY Cap | 0.0082 50 V |
| C30 | QEW61CA-476M | E Cap | 47 16 V |
| C31 | QFM71HJ-393M | MY Cap | 0.039 50 V |
| C32 | QFM31HK-103S | MY Cap | 0.01 " |
| C33 | QFM71HJ-473M | " | 0.047 " |
| C34 | " -154M | " | 0.15 " |
| C35 | " -473M | " | 0.047 " |
| C36 | QCS31HJ-271 | C Cap | 270 P " |
| C37 | QFM31HK-103S | MY Cap | 0.01 " |
| C38 | QFM41HK-104S | " | 0.1 " |
| C39 | QEE41CM-475 | T Cap | 4.7 16 V |
| C40 | QEW61CA-106M | E Cap | 10 " |
| C41 | QCS31HJ-101 | C Cap | 100 P 50 V |
| C42 | " -101 | " | 100 P " |
| C43 | QEW61CA-476M | E Cap | 47 16 V |
| C44 | QFM71HJ-472M | MY Cap | 0.0047 50 V |
| C45 | QEW61CA-476M | E Cap | 47 16 V |
| C46 | QFM71HJ-183 | MY Cap | 0.018 50 V |
| C47 | QFM41HK-104S | " | 0.1 " |
| C48 | QEW61CA-476M | E Cap | 47 16 V |
| C49 | – | – | |
| C50 | QCS31HJ-101 | C Cap | 100 P 50 V |
| C51 | QFM31HK-103S | MY Cap | 0.01 " |
| C52 | QEE41CM-475 | T Cap | 4.7 16 V |
| C53 | QEW61CA-476M | E Cap | 47 " |
| C54 | QEE41CM-475 | T Cap | 4.7 " |
| C55 | " -106 | " | 10 " |
| C56 | QFM31HK-472 | MY Cap | 0.0047 50 V |
| C57 | QEW61EA-476M | E Cap | 47 25 V |
| C58 | QFM32AK-822S | MY Cap | 0.0082 100 V |
| C59 | QEW61CA-476M | E Cap | 47 16 V |
| C60 | QFM32AK-102S | MY Cap | 0.001 100 V |
| C61 | QCS11HK-561 | C Cap | 560 P 50 V |
| C62 | QEW61HA-105M | E Cap | 1 " |
| C63 | QFM41HK-683S | MY Cap | 0.068 " |
| C64 | QEW61CA-106M | E Cap | 10 16 V |
| C65 | " -106M | " | 10 " |
| C66 | " -106M | " | 10 " |
| C67 | " -227M | " | 220 " |
| C68 | " -107M | " | 100 " |
| C69 | " -476M | " | 47 " |
| C70 | QEW61HA-475M | " | 4.7 50 V |
| C71 | QEW61CA-106M | " | 10 16 V |
| C72 | QCS31HJ-391 | C Cap | 390 P 50 V |
| C73 | QCS11HK-681 | " | 680 P " |
| C74 | QFM31HK-333S | MY Cap | 0.033 " |
| C75 | QFM32AK-222S | " | 0.0022 100 V |

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| C76 | QEW61HA-105M | E Cap | 1 50 V |
| C77 | " -105M | " | 1 " |
| C78 | QFM41HK-104 | MY Cap | 0.1 " |
| C79 | QCF31HP-473 | C Cap | 0.047 " |
| C80 | QEW61CA-476M | E Cap | 47 16 V |
| C81 | QFM31HK-103S | MY Cap | 0.01 50 V |
| C82 | QEW61CA-476M | E Cap | 47 16 V |
| C83 | — | — | — — |
| C84 | QEW61EA-476M | E Cap | 47 25 V |
| C85 | " -476M | " | 47 " |
| C86 | QFM31HK-103S | MY Cap | 0.01 50 V |
| C87 | " -103 | | 0.01 " |
| C88 | " -103S | " | 0.01 " |
| C89 | QCS11HK-561 | C Cap | 560 P " |
| C90 | QFP32XK-272 | P Cap | 0.0027 |
| C91 | " -392 | " | 0.0039 |
| C92 | QEW61CA-476M | E Cap | 47 16 V |
| C93 | QFM32AK-102S | MY Cap | 0.001 100 V |
| C94 | QCF31HP-473 | C Cap | 0.047 50 V |
| C95 | QEW61CA-336M | E Cap | 33 16 V |
| C96 | QCF31HP-223 | C Cap | 0.022 50 V |
| L 1 | A04725-330 | Peaking Coil | |
| L 2 | PU44041-104 | Choke Coil | |
| L 3 | PU30771-5 | Coil | |
| L 4 | A04725-1500 | Peaking Coil | |
| T 1 | PU30961 | Osc. Transformer | |
| S 1 | PU47001 | Slide Switch | |
| S 2 | PU47002 | " | |
| P 1 | PU43351-5 | Cap. Housing | Conn. 11—15 |
| P 2 | " -3 | " | Conn. 21—23 |
| P 3 | " -3 | " | Conn. 31—33 |
| P 4 | " -3 | " | Conn. 41—43 |
| P 5 | " -3 | " | Conn. 51—53 |
| P 6 | " -3 | " | Conn. 61—63 |
| P 7 | A74017 | Tab | Conn. 71 |
| P 8 | PU43351-3 | Cap. Housing | Conn. 81—83 |
| P 9 | — | — | |
| P10 | — | — | |
| P11 | PU43351-7 | Cap. Housing | Conn. 111—117 |
| P12 | " -3 | " | Conn. 121—123 |
| P13 | " -7 | " | Conn. 131—137 |
| P14 | " -4 | " | Conn. 141—144 |
| P15 | " -3 | " | Conn. 151—153 |
| | PU46812 | Insulator | |
| | PU46483 | Shield Cover | |
| | PU43092 | Collar | for R8, 97, 109, 117, 118 |
| | PU40734 | | |

## 11-7 JUMP BOARD ASS'Y . . . . . PU46180C

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU20629-2 | Printed board | |
| D 1 | MA150 | Diode | |
| D 2 | " | " | |
| D 3 | " | " | |
| R 1 | QRD141K-473 | CR | 47 K 1/4 W, K |
| | PU43351-4 | Cap. Housing | |

## 11-8 MECHANISM CONTROL PRINTED CIRCUIT BOARD ASS'Y . . . . . PU47087A

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU31889 | Printed board | |
| IC 1 | MSM4011 | Integrated Circuit | or UPD4011C |
| IC 2 | CD4023UBE | " | or UPD4023C |
| IC 3 | UA741TC | " | or UPC741C |
| X 1 | 2SC829C | Transistor | |
| X 2 | 2SC1213C | " | |
| X 3 | 2SC1162WTC | " | |
| X 4 | 2SC829C | " | |
| X 5 | 2SC829C | " | |
| X 6 | 2SC1213C | " | |
| X 7 | 2SD389O | " | |
| X 8 | 2SC829C | " | |
| D 1 | MA150 | Diode | or 1S2473 |
| D 2 | " | " | " |
| D 3 | OA91 | " | |
| D 4 | MA150 | " | or 1S2473 |
| D 5 | " | " | " |
| D 6 | " | " | " |
| D 7 | " | " | " |
| D 8 | " | " | " |
| D 9 | OA91 | " | |
| D10 | " | " | |
| D11 | – | – | |
| D12 | VO3C | Diode | |
| D13 | MA150 | " | or 1S2473 |
| D14 | RD12EB | Zener Diode | |
| D15 | MA150 | Diode | or 1S2473 |
| D16 | " | " | " |
| D17 | " | " | " |
| D18 | OA91 | " | |
| D19 | MA150 | " | or 1S2473 |
| R 1 | – | – | |
| R 2 | QRG016J-680 | OMF R | 68 1 W, J |
| R 3 | QRD187K-823 | CR | 82 K 1/8 W, K |
| R 4 | " -103 | " | 10 K " |
| R 5 | " -104 | " | 100 K " |
| R 6 | " -333 | " | 33 K " |
| R 7 | " -103 | " | 10 K " |
| R 8 | " -333 | " | 33 K " |
| R 9 | " -102 | " | 1 K " |
| R10 | " -333 | " | 33 K " |
| R11 | " -474 | " | 470 K " |
| R12 | " -105 | " | 1 M " |
| R13 | " -222 | " | 2.2 K " |
| R14 | – | – | |
| R15 | QRD187K-474 | CR | 470 K 1/8 W, K |
| R16 | " -393 | " | 39 K " |
| R17 | " -223 | " | 22 K " |
| R18 | " -103 | " | 10 K " |
| R19 | " -103 | " | 10 K " |
| R20 | " -104 | " | 100 K " |
| R21 | " -104 | " | 100 K " |
| R22 | " -473 | " | 47 K " |
| R23 | " -104 | " | 100 K " |
| R24 | " -104 | " | 100 K " |
| R25 | " -223 | " | 22 K " |
| R26 | " -474 | " | 470 K " |
| R27 | " -222 | " | 2.2 K " |
| R28 | " -475 | " | 4.7 M " |
| R29 | QRD187K-333 | CR | 33 K 1/8 W, K |
| R30 | " -472 | " | 4.7 K " |
| R31 | " -473 | " | 47 K " |
| R32 | " -823 | " | 82 K " |
| R33 | " -103 | " | 10 K " |
| C 1 | QEE41EM-106 | T Cap | 10 25 V |
| C 2 | " -106 | " | 10 " |
| C 3 | QEW51HA-105 | E Cap | 1 50 V |
| C 4 | " -105 | " | 1 " |
| C 5 | QEW51EA-107 | " | 100 25 V |
| C 6 | QEC41CM-107M | " | 100 16 V |
| | PU43092 | Collar | R2 |
| | A74138 | Pin | TP1, 2 |
| | PU43351-3 | Cap. Housing | Conn. 1, 2, 3, 5 |
| | " -6 | " | Conn. 6 |

## 11-9 OPERATION BOARD ASS'Y . . . . . PU46179B

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU20628 | Printed board | |
| S 1 | QSM1S01-014 | Microswitch | |
| S 2 | " -010 | " | |
| S 3 | " -014 | " | |
| S 4 | " -014 | " | |
| S 5 | " -014 | " | |
| | PU43351-3Y | Cap. Housing | Conn. 6 |
| | PU43351-3 | " | Conn. 7 |

## 11-10 TAPE GUARD CIRCUIT BOARD ASS'Y . . . . . PU46187A

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46176 | Printed board | |
| | PN202S | Photo Transistor | |
| | 5082-4694 | L.E.D. | |
| R 1 | QRD121K-681 | CR | 680 1/2 W, K |
| R 2 | QRD181K-123 | " | 12 K 1/8 W,K |
| R 3 | " -473 | " | 47 K " |
| | PU44897-2 | Shade | |

## 11-11 VIDEO HEAD CIRCUIT BOARD ASS'Y . . . . . PU46186A

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46172 | Printed board | |
| X 1 | 2SC2021Q | Transistor | |
| X 2 | " | " | |
| D 1 | 1S2473 | Diode | |
| R 1 | QRD181J-474 | CR | 470 K 1/8 W, J |
| R 2 | " -224 | " | 220 K " |
| R 3 | " -223 | " | 22 K " |
| C 1 | QCF11HP-102 | C Cap | 0.001 50 V |

## 11-12 A.E./A & CTL HEAD BOARD

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46436 | Printed board | |
| | PU46435M | A/E - A/CTL Head Ass'y | |

## 11-13 FULL ERASE HEAD BOARD

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU44742 | Printed board | |
| | PU31013 | Full Erase Head | |

## 11-14 LED BOARD ASS'Y . . . . . PU46188A

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46173 | Printed board | |
| D 1 | 5082-4657 | L.E.D. | |
| D 2 | 5082-4557 | " | |
| | PU43351-103 | Cap. Housing | |

## 11-15 START SENSOR CIRCUIT BOARD

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46171 | Printed board | |
| | PN202S | Photo Transistor | |
| R 1 | QRD141J-123 | CR | 12 K 1/4 W, K |
| R 2 | " -473 | " | 47 K " |
| | PU44897 | Shade | |

## 11-16 END SENSOR CIRCUIT BOARD

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46171 | Printed board | |
| | PN202S | Photo Transistor | |
| R 1 | QRD141K-123 | CR | 12 K 1/4 W, K |
| R 2 | " -473 | " | 47 K " |
| | PU44897 | Shade | |

## 11-17 POWER TRANSISTOR BOARD (1)

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46174 | Printed board | |
| X 1 | 2SD389O | Transistor | |
| | PU45375-1 | Spacer | |
| | PU41624-6 | Insulator | |

## 11-18 POWER TRANSISTOR BOARD (2)

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU46175 | Printed board | |
| X 1 | 2SD389O | Transistor | |
| | PU45375 | Spacer | |
| | PU41624-6 | Insulator | |

## 11-19 POWER TRANSISTOR BOARD (3)

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU47181 | Printed Board | |
| X 1 | 2SD723 | Transistor | |
| | PU45375 | Spacer | |
| | PU41624-6 | Indulator | |

## 11-20 TERMINAL BOARD

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU44674 | Printed board | |

No. 8136

# JVC Service Manual

AA-P41E

MODEL **AA-P41E**

## VICTOR COMPANY OF JAPAN, LIMITED

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## 1.1 SPECIFICATIONS

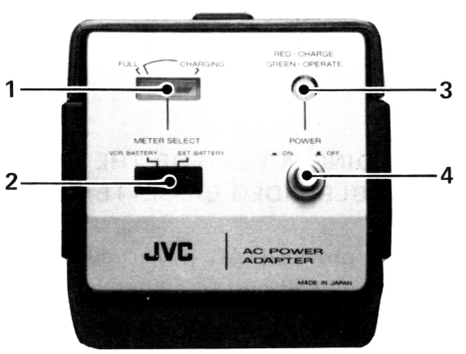
| | |
|---|---|
| Power source | : 110/127/220/240 V∿, 50 Hz |
| Rated output voltage | : 12 V DC |
| Rated output current | : 2.3 A |
| Charging meter | : Provided |
| Dimensions | : 12.8 cm (W) x 13.8 cm (H) x 32.9 cm (D) (5-1/8" x 5-1/2" x 12-15/16") |
| Weight | : 3.4 kg (7.5 lb.) |
| Accessory provided | : AC power cord |

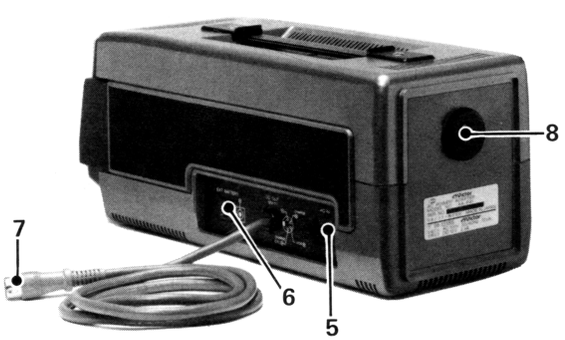
*Design and specifications subject to change without notice.*

## 1.2 PRECAUTIONS

- The AA-P41EG/EK is exclusively used with JVC HR-4100EG/EK portable video cassette recorder and cannot be employed for other video recorders.
- Be careful not to block the ventilation openings. Heat is generated inside the unit.
- Do not allow inflammables, water or metallic objects to enter the unit, as this will cause damage or malfunctioning.

## 1.3 CONNECTORS AND CONTROLS




1. **Charging meter**
   Indicates the charge condition of the PBP-1 battery pack when used externally or while inside the recorder, depending on the position of the METER SELECT switch.
2. **Pilot lamp (REC - CHARGE, GREEN - OPERATE)**
   Lights red while charging battery.
   Lights green while providing DC power for the JVC HR-4100EG/EK from an AC outlet.
3. **METER SELECT switch**
   Set to the VCR BATTERY position when checking the meter for the condition of the battery pack inside the recorder.
   Set to the EXT BATTERY position when checking the condition of the external battery pack.

### POWER SYSTEM

**Connection to the mains supply**

The operating voltage of this AC power adapter is preset to 220 V or 240 V∿ at the factory.
Before connecting to mains, check that the voltage selector on the rear panel is set to the same voltage as your local mains supply.

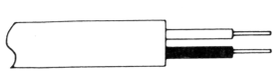
**Adapting to local power line**

The AC power adapter operates on either 110, 127, 220 or 240 V∿. The voltage selector can be reset as follows. Turn the fuse holder and remove the holder. Pull out the voltage selector plug and reinsert it so that the proper voltage appears at the cutout.

### IMPORTANT (In the United Kingdom) Mains Supply (AC 240 V∿, 50 Hz only)

**IMPORTANT**

Do not make any connection to the Larger Terminal coded E or Green. The wires in the mains lead are coloured in accordance with following code:



Blue to N (Neutral) or Black
Brown to L (Live) or Red

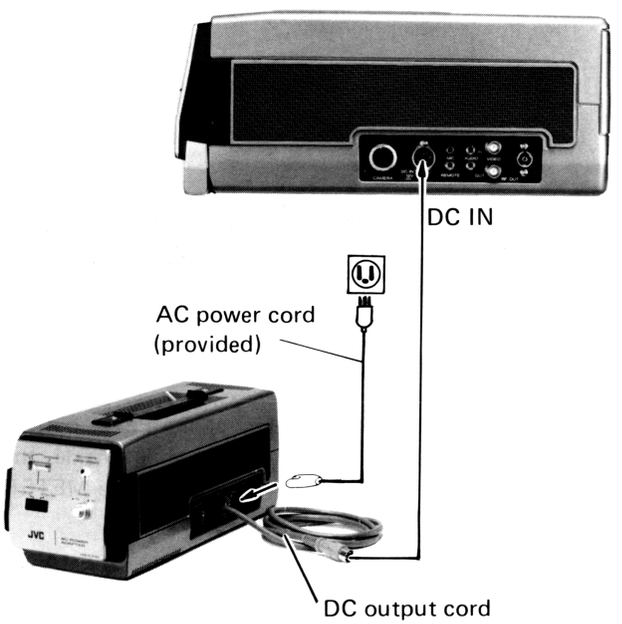
If these colours do not correspond with the terminal identifications of your plug, connect as follows:
Blue wire to terminal coded N (Neutral) or coloured Black. Brown wire to terminal coded L (Live) or coloured Red.
*If in doubt — consult a competent electrician.*

**Note:** We recommend that you should disconnect the AC cord from the outlet.

4. **POWER switch**
   Depress to turn the power ON. Press to turn power OFF.
5. **AC IN jack**
   Connect the provided power cord to this jack.
6. **EXT BATTERY socket**
   For connection to the battery for recharging.
7. **DC output cord**
   Connect to the recorder's DC IN connector to provide power for the recorder or to recharge the PBP-1 battery pack inside the recorder.
8. **Fuse holder/voltage selector**
   Set to the power supply voltage in your area. (See "POWER SYSTEM".)

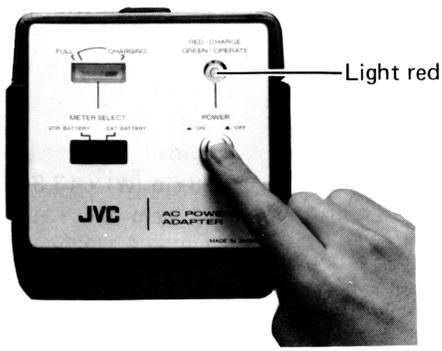
## 1.4 PROVIDING POWER FOR THE HR-4100EG/EK PORTABLE VIDEO CASSETTE RECORDER

1. Using the provided AC power cord, connect the AC IN jack of this unit to a household AC outlet.
2. Connect the DC output cord of this unit to the recorder's DC IN connector.

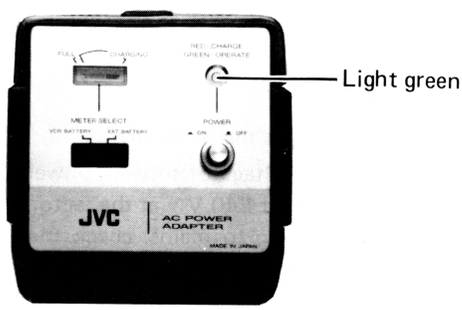



3. Depress the POWER switch to turn power on. Then, pilot lamp lights red.

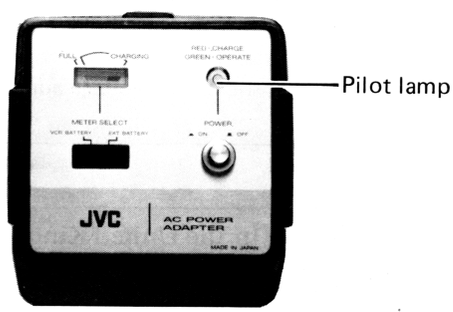
> When turning off the power, be sure to set the recorder in the Stop mode first.




4. Operate the recorder and the pilot lamp lights green.




**Pilot Lamp Indication**



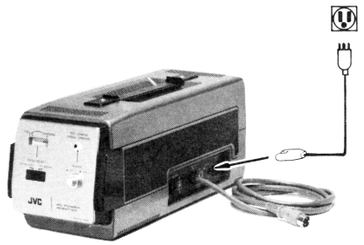

**Red** . . . . .when the recorder is in the Stop mode or when recharging the batteries. When the recorder is in the Stop mode, both the battery inside the recorder and the external battery are automatically being recharged.

**Green** . . . .when the recorder is being operated. Recording, Playback, Fast Forward and Rewind modes. The batteries are not being recharged while the recorder is in operation.

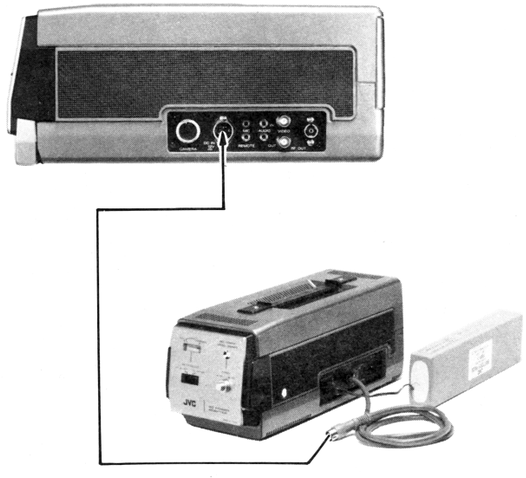
## 1.5 RECHARGING THE PBP-1 BATTERY PACK SEPARATELY

The AA-P41EG/EK can be used to recharge an external PBP-1 battery pack and the battery pack inside the recorder at the same time.

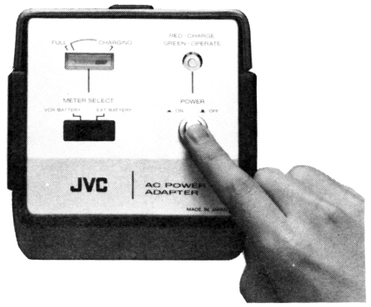
1. Using the provided AC power cord, connect the AC IN jack of this unit to a household AC outlet.



2. Connect the PBP-1 battery pack to the EXT BATTERY socket of this unit.
3. Connect the DC output cord of this unit to the recorder's DC IN 12 V connector when recharging an external battery pack and the one inside the recorder at the same time.
   (Be sure to set the recorder in the Stop mode.)



4. Depress the POWER switch to turn it on. The pilot lamp lights red.
   (If the pilot lamp lights green, set the recorder in the Stop mode. Otherwise recharging cannot be performed.)
5. Set the METER SELECT switch to the VCR BATTERY or EXT BATTERY to check the battery charging condition of either.
   (Refer to the section "READING THE CHARGING METER".)



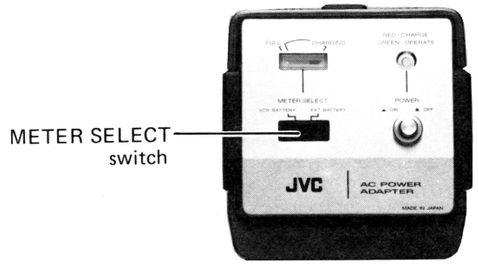

**CAUTION!**

- Be sure not to carry or move this unit with the external PBP-1 battery pack connected to the EXT BATTERY socket. Do not pull the PBP-1 battery pack cord as it may be dangerous.

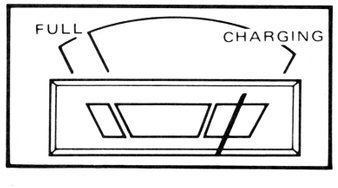
## 1.6 READING THE CHARGING METER

It is possible to check the battery charging condition of either battery pack by using the METER SELECT switch.

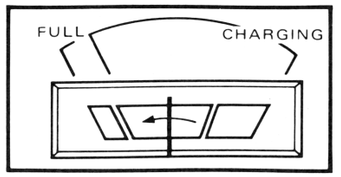
1. Set the METER SELECT switch according to the battery to be checked.
   VCR BATTERY . . . . . to check the PBP-1 inside the recorder.
   EXT BATTERY . . . . . to check the external PBP-1 connected to the EXT BATTERY socket of this unit.



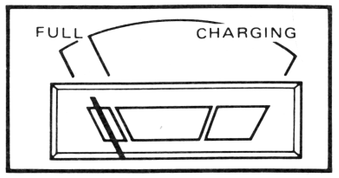

2. When charging starts, the needle deflects to the right.




3. As charging proceeds, the needle gradually moves toward the "FULL" position.



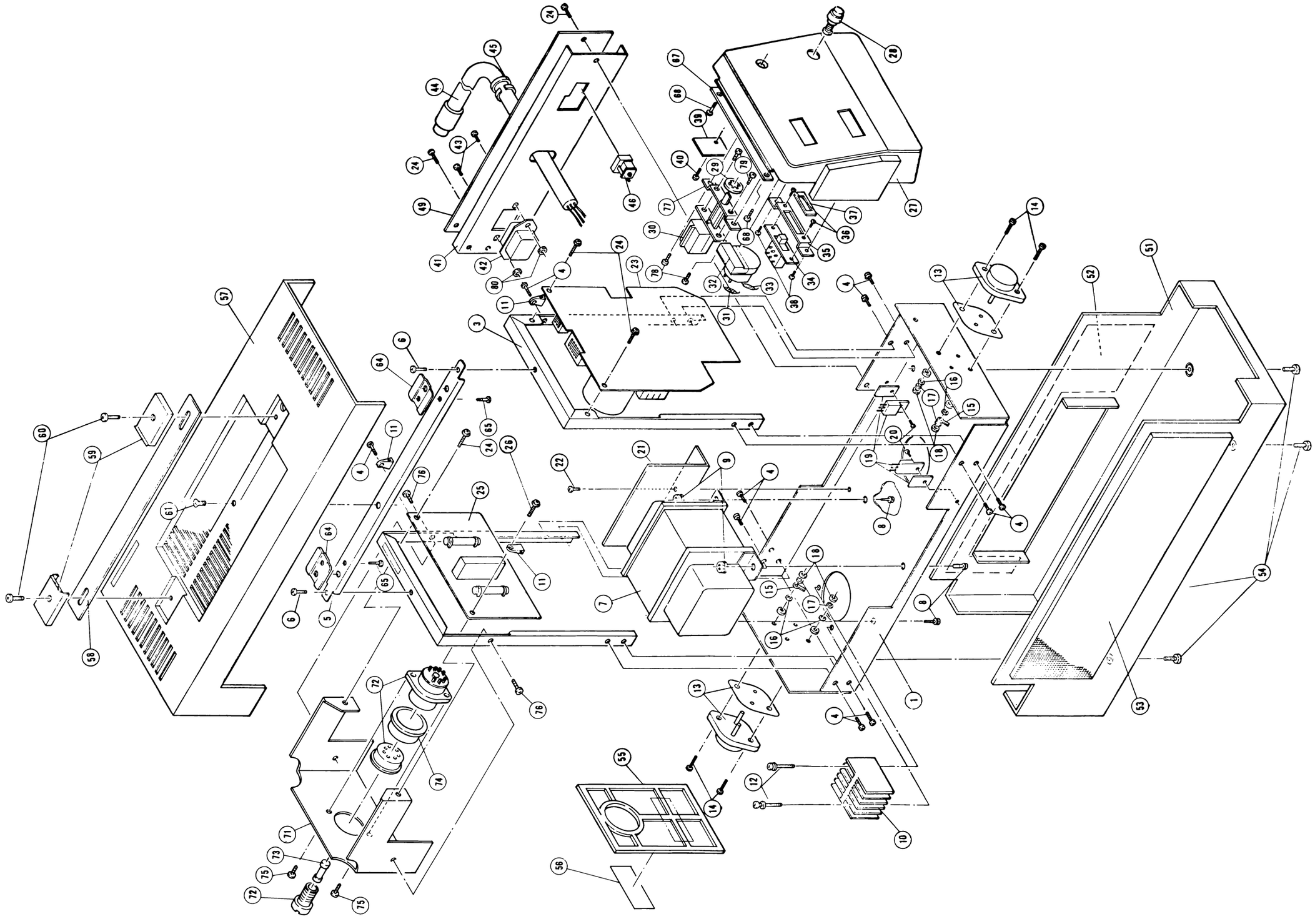

4. The battery pack is fully charged when the needle indicates FULL.




**CAUTION!**

- A discharged battery pack will need up to approx. 8 hours to recharge.
- Always recharge the PBP-1 Battery Pack immediately after use, regardless of how much of the power has been used. Store the battery pack 100% charged. If it is left discharged after use, it will continue to discharge, shortening its life or sometimes making it unusable.
- Be sure to recharge the battery pack when using it after storage of longer periods of time.

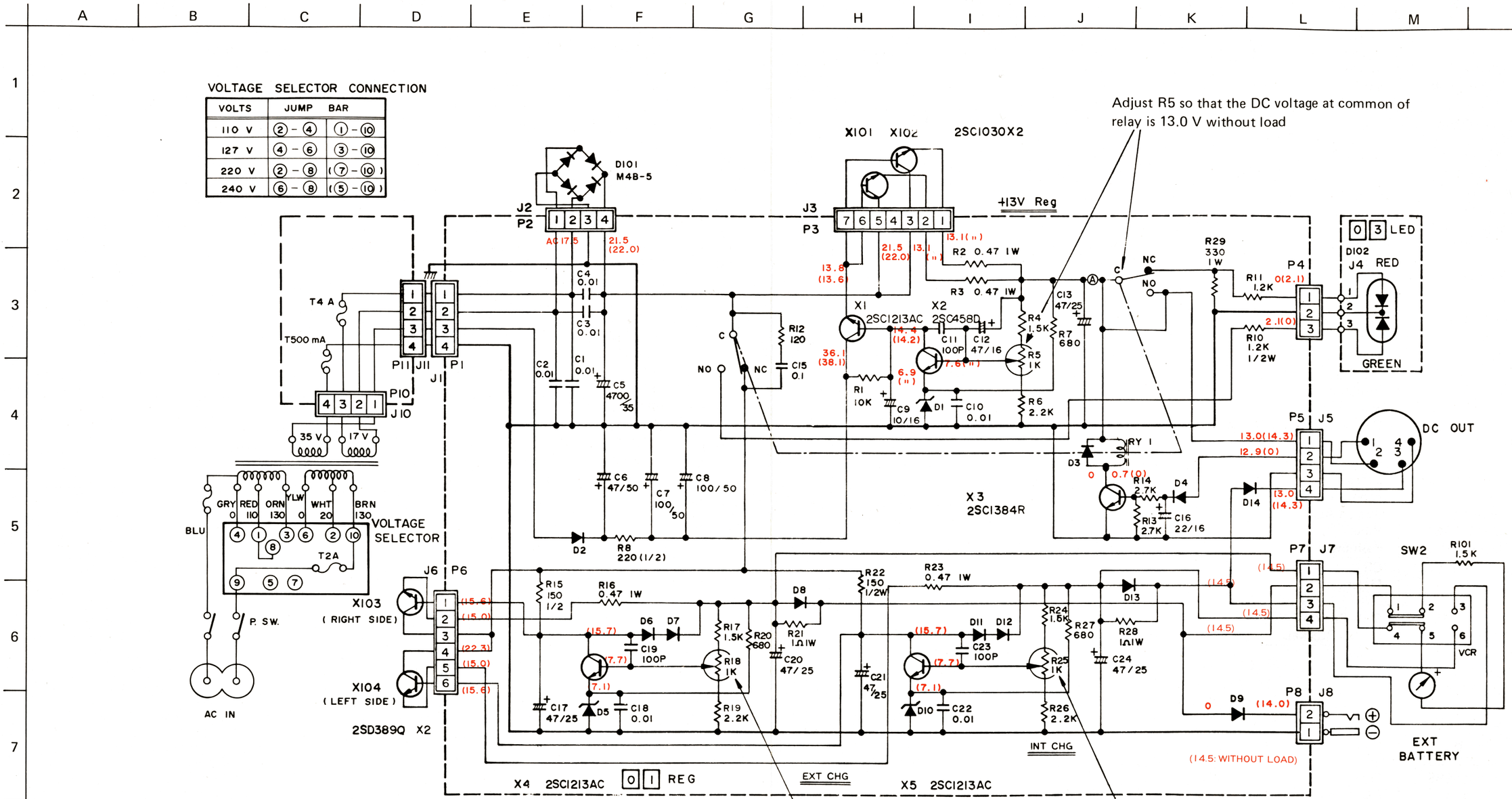
## 1.7 EXPLODED VIEW



| Symbol No. | Part No. | Part Name | Remarks |
|---|---|---|---|
| 1 | *PU20653 | Chassis | |
| 2 | *PU31957 | Bracket | Rear |
| 3 | *PU31597 | Bracket | Front |
| 4 | LPSP3006ZS | Screw | |
| 5 | *PU31577 | Stay | |
| 6 | LPSP3006ZS | Screw | |
| 7 | PU31672 | Power Transformer | |
| 8 | DPSP4010ZS | Screw | |
| 9 | NFS4000ZS | Nut | |
| 10 | M4B-51-11 | Diode | D1 |
| 11 | PU4381 | Holder | |
| 12 | DPSP3014ZS | Screw | |
| 13 | 2SC1030C | Transistor | X101, X102 |
| 14 | SPSP3012NS | Screw | |
| 15 | A50517 | Earth Lug | |
| 16 | WNS3000N | Washer | |
| 17 | WLS3000N | Lock Washer | |
| 18 | NNS3000NS | Nut | |
| 19 | 2SD389Q | Transistor | |
| 20 | SPKP3008-9 | Screw | |
| 21 | *PU31583 | Insulator | |
| 22 | LPSP3006ZS | Screw | |
| 23 | – | Regulator P.C. Board Ass'y | |
| 24 | DPSP3006ZS | Screw | |
| 25 | – | Fuse Board Ass'y | |
| 26 | DPSP3008ZS | Screw | |
| 27 | *PU31582D | Front Cover Ass'y | |
| 28 | *TJB342206-0A | Button Ass'y | |
| 29 | RDS12000F | Ring | |
| 30 | QSP2111-011 | Push Switch | |
| 31 | QRD141K-152 | CR | |
| 32 | PU30899 | Meter | |
| 33 | – | – | — |
| 34 | QSS2228-101 | Slide Switch | |
| 35 | *PU46362 | Switch Bracket | |
| 36 | SSSP3006ZS | Screw | |
| 37 | *PU46456 | Switch Cover | |
| 38 | SBSB3008ZS | Tapping Screw | |
| 39 | – | LED Board Ass'y | |
| 40 | SBSB3008ZS | Tapping Screw | |
| 41 | PU31578 | Connector Bracket | |
| 42 | QMC9017-001 | AC Connector | |
| 43 | SDBP3008BS | Screw | |
| 44 | *PU31544B | DC Cord Ass'y | |
| 45 | QHS6374-162 | Cord Stopper | (except A74069-4 Mini Housing) |
| 46 | QMA1221-001 | Jack Ass'y | |
| 47 | – | – | |
| 48 | – | – | |
| 49 | PU31955 | Connector Panel | |
| 50 | – | – | |
| 51 | *PU10130 | Bottom Cover | |
| 52 | *PU31581 | Side Sheet | Right |
| 53 | *PU31554 | Side Sheet | Left |
| 54 | SDSP3008NS | Screw | |
| 55 | PU31954 | Rear Cover | |

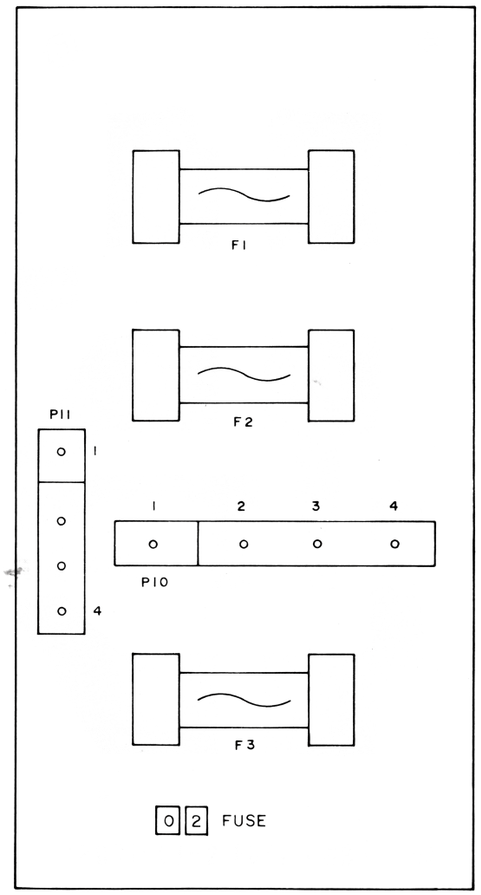
| Symbol No. | Part No. | Part Name | Remarks |
|---|---|---|---|
| 56 | *PU30931-21 | Serial No. Plate | HR-4100EK |
| | PU30931-22 | Serial No. Plate | HR-4100EG |
| 57 | *PU10131 | Top Cover | |
| 58 | *PU46361 | Handle | |
| 59 | *PU46385 | Handle Cover | |
| 60 | SHBP4016RS | Screw | |
| 61 | SSSP3006NS | Screw | |
| 62 | – | – | |
| 63 | – | – | |
| 64 | PU46543 | Holder | |
| 65 | SPSP4004ZS | Screw | |
| 66 | – | – | |
| 67 | PU46643 | Stopper | |
| 68 | SBSB3008Z | Tapping Screw | |
| 69 | – | – | |
| 70 | – | – | |
| 71 | PU31956 | Bracket | |
| 72 | PU45383-2 | Voltage Selector | |
| 73 | QMF51A2-2R0 | Fuse | 2 AT |
| 74 | C40621 | Cover | |
| 75 | LPSP3010ZS | Screw | |
| 76 | LPSP3006ZS | Screw | |
| 77 | PU47259 | Bracket | |
| 78 | SBSB3008Z | Tapping Screw | |
| 79 | LPSP3006Z | Screw | |
| 80 | NNS3000N | Nut | |

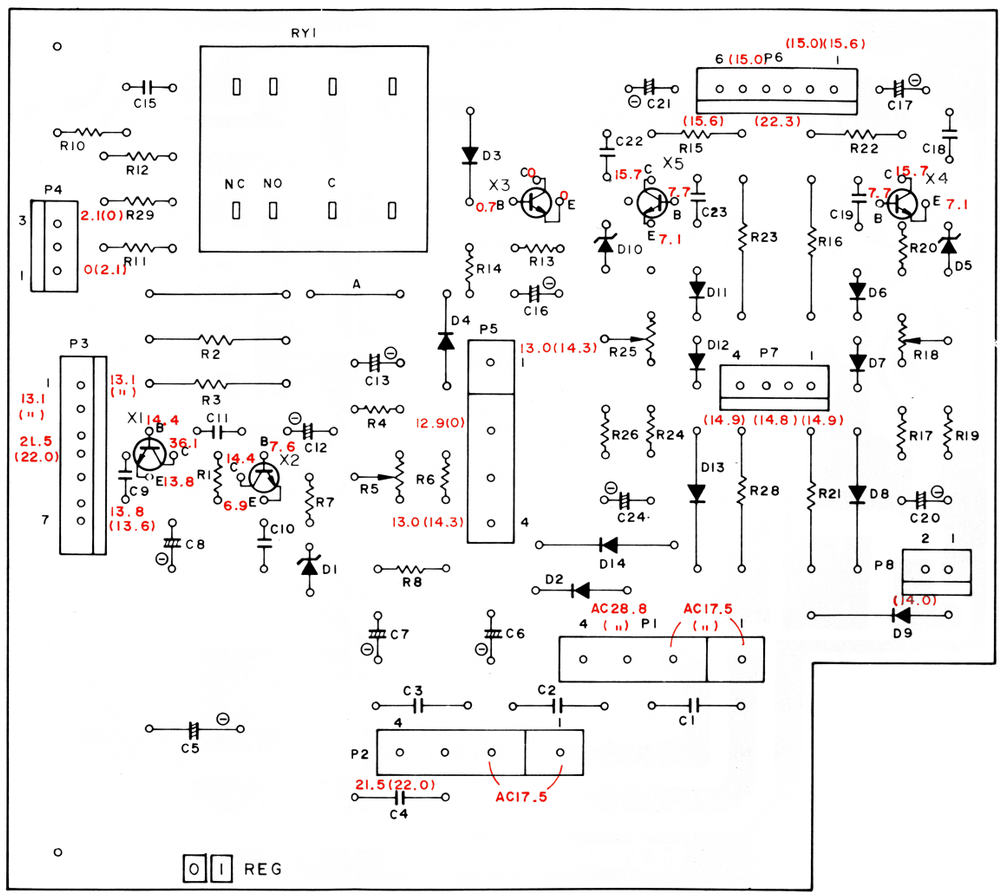
## 1.8 AC POWER ADAPTOR SHEMATIC DIAGRAM

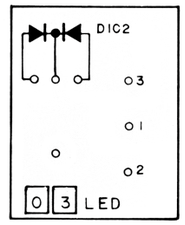



NOTE ) UNLESS OTHERWITH SPECIFIED

1. DIODE
   - D1, 5, 10, RD6.8EC
   - D2, 3, 4 W03C
   - D6, 7, 11, 12 IS2473VE
   - D8, 9, 13, 14, U05E
2. RESISTORS ARE IN OHMS 1/4W.
3. CAPACITERS ARE IN MICROFARADS
4. MARKED BY [ ] ARE LOCATED ON THE P.W.B


F1
F2
P11
P10
F3
0 2 FUSE


RY1
NC NO C
P4
P3
P5
P7
P6
P8
P1
P2
A
X1
X2
X3
X4
X5
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
R1
R2
R3
R4
R5
R6
R7
R8
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R28
R29
0 1 REG


D1C2
0 3 LED

## 1.10 REGULATOR CIRCUIT BOARD ASS'Y... PU46354C

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU31543 | Printed Board | |
| X 1 | 2SC1213AC | Transistor | |
| X 2 | 2SC458D | " | |
| X 3 | 2SC1384R | " | |
| X 4 | 2SC1213AC | " | |
| X 5 | 2SC1213AC | " | |
| D 1 | RD6.8EC | Zener Diode | |
| D 2 | WO3C | Diode | |
| D 3 | WO3C | " | |
| D 4 | WO3C | " | |
| D 5 | RD6.8EC | Zener Diode | |
| D 6 | 1S2473VE | Diode | |
| D 7 | 1S2473VE | " | |
| D 8 | U05E | " | |
| D 9 | U05E | " | |
| D10 | RD6.8EC | Zener Diode | |
| D11 | 1S2473VE | Diode | |
| D12 | 1S2473VE | " | |
| D13 | U05E | " | |
| D14 | U05E | " | |
| R 1 | QRD143K-103 | CR | 10 K ¼ W, K |
| R 2 | QRX019J-R47 | MFR | 0.47 1 W, J |
| R 3 | " -R47 | " | 0.47 " |
| R 4 | QRD143K-152 | CR | 1.5 K ¼ W, K |
| R 5 | QVP4A0B-102 | VR | 1 K |
| R 6 | QRD143K-222 | CR | 2.2 K ¼ W, K |
| R 7 | " -681 | " | 680 " |
| R 8 | QRD123K-221 | " | 220 ½ W, K |
| R 9 | – | – | |
| R10 | QRD123K-122 | CR | 1.2 K ½ W, K |
| R11 | QRD143K-122 | " | 1.2 K ¼ W, K |
| R12 | " -121 | " | 120 " |
| R13 | " -272 | " | 2.7 K " |
| R14 | " -272 | " | 2.7 K " |
| R15 | QRX126J-151 | MFR | 150 ½ W, J |
| R16 | QRX019J-R47 | " | 0.47 1 W, J |
| R17 | QRD143K-152 | CR | 1.5 K ¼ W, K |
| R18 | QVZ3505-102 | VR | 1 K |
| R19 | QRD143K-222 | CR | 2.2 K ¼ W, K |
| R20 | " -681 | " | 680 " |
| R21 | QRX019J-1R0 | MFR | 1 1 W, J |
| R22 | QRX126J-151 | " | 150 ½ W, J |
| R23 | QRX019J-R47 | " | 0.47 1 W, J |
| R24 | QRD143K-152 | CR | 1.5 K ¼ W, K |
| R25 | QVP4A0B-102 | VR | 1 K |
| R26 | QRD143K-222 | CR | 2.2 K ¼ W, K |
| R27 | " -681 | " | 680 " |
| R28 | QRX019J-1R0 | MFR | 1 1 W, J |
| R29 | QRX016J-331 | " | 330 " |
| C 5 | QEW71VH-478 | E Cap | 470 35 V |
| C 6 | QEW41HA-476 | " | 47 50 V |
| C 7 | QET41HR-107 | " | 100 " |
| C 8 | " -107 | " | 100 " |
| C 9 | QET41VR-106 | " | 10 16 V |
| C10 | QFM41HK-103 | MY Cap | 0.01 50 V |
| C11 | QCS11HK-101 | C Cap | 100 P 50 V |
| C12 | QEW41CA-476 | E Cap | 47 16 V |
| C13 | QEW41ER-476 | " | 47 25 V |
| C14 | QFM41HK-104 | MY Cap | 0.1 50 V |
| C15 | QFM41HK-104 | MY Cap | 0.1 50 V |
| C16 | QEW41CA-226 | E Cap | 22 16 V |
| C17 | QEW41ER-476 | " | 47 25 V |
| C18 | QFM41HK-103 | MY Cap | 0.01 50 V |
| C19 | QCS11HK-101 | C Cap | 100 P " |
| C20 | QEW41ER-476 | E Cap | 47 25 V |
| C21 | " -476 | " | 47 " |
| C22 | QFM41HK-103 | MY Cap | 0.01 50 V |
| C23 | QCS11HK-101 | C Cap | 100 P " |
| C24 | QEW41ER-476 | E Cap | 47 25 V |
| C25 | QFM52AM-474 | MY Cap | 0.47 |
| RY-1 | PU44335 | Relay | |
| | A75820-4 | Connector base | |
| | PU43351-2 | Cap. Housing | |
| | " -3 | " | |
| | " -4 | " | |
| | " -6 | " | |
| | " -7 | " | |

## 1.11 FUSE BOARD ASS'Y ..... PU46355C

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| | PU31543-2 | Printed Board | |
| F 2 | QMF51A2-4R0-BS | Fuse | |
| F 3 | " -R50-BS | " | |
| | A44594-001 | Fuse Holder | |
| | A74021-BS | Connector Base | |
| | A75802-4 | " | |

## 1.12 LED BOARD

| Symbol No. | Part No. | Part Name | Description |
|---|---|---|---|
| D102 | PU46267T | LED | |
| | PU46515 | Base | |